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Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

No. 185

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NONDESTRUCTIVE IN-SERVICE TESTING OF NUCLEAR PLANTS DISCUSSED

Prague JADERNA ENERGIE in Czech No 11, 1982 pp 392-407

[Article by Stanislav Havel, Jaroslav Kadlec, and Frantisek Kasak, Institute of Nuclear Research, Rez: "Nondestructive Inservice Testing and Inspection in Nuclear Power Stations. Part 3. Promising Methods of Inservice Inspection of Primary Circuits"]

[Text] The best-developed among the promising methods are the acoustic emission method for testing the condition and behavior of stressed components, and ultrasonic holography, which gives a visible image of defects. Infrared television monitoring systems, which are already in wide use in several sectors, may also be of value in inspection of nuclear power stations.

Acoustic Emission Testing

If a metal is stressed (this also applies to the crystalline level), microstrain processes take place in it and high-frequency elastic waves (SWE, stress wave emissions), generally at about 10 MHz, propagate through the materials; these are called acoustic emissions. Such emissions may be burst-type or continuous, depending on the nature of the material. The phenomenon is intensified at cracks, inclusions and the like, and may be detected and located by means of suitably placed sensors. Defects of secondary importance may be eliminated, while defects of importance in safety terms may be detected. Repeated stressing (e.g., in hydrostatic tests) creates the conditions for a phenomenon which involves greater stress or a new or more extensive type of defect compared with the previous condition (Kaiser effect). In this method, the material must be under a certain stress. Acoustic pulses are detected at the surface of a component by ceramic piezoelectric transducers (Pb-Zr titanate, Curie temperature $\sim$350° C), which emit an electrical signal proportional to the pressure. This signal is amplified, usually in a low-noise preamplifier close to the transducer, and fed by cable to the main amplifier. Because the pulses are often small, the signal-to-noise ratio becomes important. In order to minimize noise, only a very narrow preamplifier band, e.g., from 1,000 Hz to 3.0 MHz, is used.

The pulses that are detected are processed by either of two methods. In the first, the emitting defect is evaluated in terms of the number of pulses per second using a single sensor; in the other, many sensors (4 to 32 or even more) are used together with a suitable timing circuit to locate the defect relative to the sensors. An increased number of sensors also increases the complexity and cost of the equipment, particularly the data processing equipment for calculating the locations of the defects. A general block diagram of the acoustic emission method is shown in Figure 16.

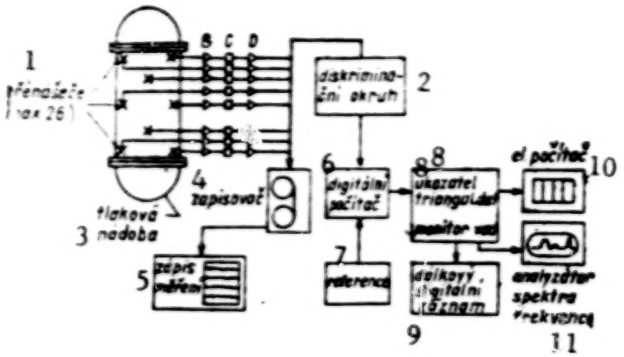


Figure 16. Block Diagram of Acoustic Emission Method

Key:

1. Transducers (max 26)
2. Discriminator
3. Pressure vessel
4. Recorder
5. Recording of measurements
6. Digital computer
7. Reference
8. Triangulation data indicator, defect monitor
9. Remote digital recording
10. Electronic computer
11. Frequency spectrum analyzer

A great advantage of the acoustic emission method is that it is the only known method which gives 100 percent detection and location of faults in the stressed state in a single operation. This gives great reliability in evaluating the integrity of pressure vessels or other nondestructive tests.

There is as yet insufficient experience in quantifying the defect in terms of its emissions; accordingly, once found, a defect must be evaluated by other methods. If the acoustic emission method is used in with the reactor in service, the measurements are considerably affected by systematic sources of noise, particularly hydraulic flow of the coolant and cavitation. The method does not detect defects resulting from thermal stresses, because these do not produce acoustic emissions.

Hydrostatic Pressure Tests in Connection With Acoustic Emission Tests

Hydrostatic pressure testing, which is frequently used in reactor component testing, gains a new significance in connection with the acoustic emissions method.

The operating safety of reactor pressurized circuit components is limited primarily by materials properties, technology and operating conditions. An important criterion is the so-called "critical crack length," i.e., the maximum length of a crack penetrating deep into the walls. Every repetition of a test involving overpressure may further decrease service life (and safety) of the components, particularly welded ones.

Therefore the hydrostatic pressure tests required by the ASME [American Society of Mechanical Engineers] Code, Section XI, for inservice inspection are intended primarily to find component leaks under pressure, not to give a quantitative idea of pressure vessel integrity. The latter is determined more precisely by considering failure mechanics in the situation in question and by improved nondestructive methods.

Ultrasonic Holography

Ultrasonic holography may result in a further expansion of nondestructive methods of inservice inspection of pressure vessels. This testing is conducted on low-alloy steel using demineralized water at a temperature T_{Ko} .+ 30° C (T_{Ko} is the critical brittleness temperature).

In principle, ultrasound is used as an irradiation source to produce a visible image of defects in nonradiation-transparent material and to quantify them. After irradiation with coherent light, the ultrasonic image can be viewed optically; it is called a hologram.

The arrangement of an ultrasonic holographic device is shown in Figure 17.

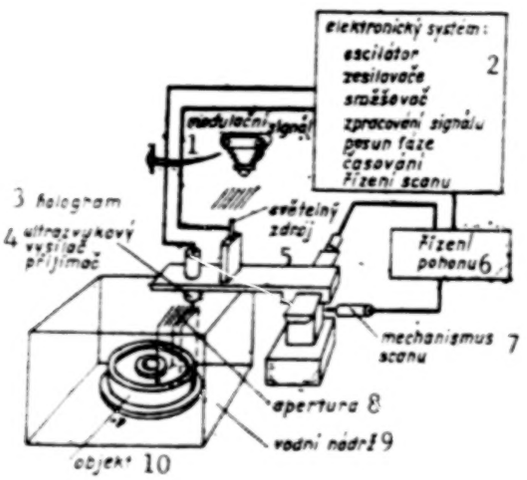


Figure 17. Ultrasonic Holography

Key:

1. Modulating signal
2. Electronic system: oscillator, amplifier, mixer, signal processing, phase shifter, timing, scan control
3. Hologram
4. Ultrasonic transceiver
5. Light source
6. Drive control
7. Scan mechanism
8. Aperture
9. Water tank
10. Object

In the detection field, ultrasonic holography is reminiscent of conventional C-sensing. A single focused ultrasonic transducer (e.g. a transducer) successively analyzes (under water) a specified part of the item, called the aperture. Operating in the pulse-echo mode, the transducer uses time synchronization to isolate echo-producing defects. Electronic circuits mix the echoes with the reference signals from the pulse transducer and compare the two. A phase shifter is used to impose a linear grid on the hologram. The output from this operation is used to modulate a light source, which moves in synchrony with the transducer. The resultant light field is recorded on Polaroid film as an acoustic hologram. To produce the reconstructed optical image from the acoustic hologram, the latter must be placed on an optical bench as shown in Figure 18.

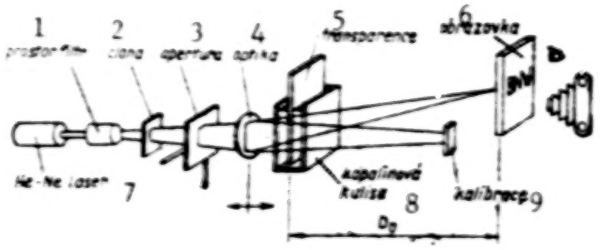


Figure 18. Optical Reconstruction System

Key:

1. Spatial filter
2. Diaphragm
3. Aperture
4. Optics
5. Transparency
6. Display
7. He-Ne laser
8. Liquid-filled holder
9. Calibration

The hologram gives a direct image of the details of defects occurring in the object. Use of this method for inservice inspection is still in the development stage.

Thermography

Thermography is based on the principle that everything around us emits heat, i.e., infrared radiation; this is invisible to the naked eye, but a thermovision system with an infrared camera can give a thermographic image of the locations being inspected. The display makes it possible to distinguish different surface temperatures as bright and dark areas.

Commercial equipment (e.g., that from the AGA Corp) has already proven to be of value in assuring economical, safe operation in many fields.

Timely, rapid inservice testing of dangerous points in pressure equipment is now possible.

9. Equipment for Remote-Controlled Testing

All testing procedures in the inspection of nuclear reactor pressure circuit components must be nondestructive, and in particular must not themselves degrade equipment performance. After installation, the scope of the nondestructive tests which were initially suitable for the preservice stage of equipment testing may be considerably decreased, or various compromises may be made depending on the initial situation.

Because of the unsafe radiation environment, most inservice inspections must be carried out by remote control, using mechanical equipment. Various remote-controlled manipulators are used for inspections of reactor pressure vessels. Suppliers of pressure vessels or specialized institutions take part in their development.

Reactor vessels may be tested by remote control either internally or externally, or in both ways, but the conditions are considerably different. The design of positioning devices is determined by many circumstances, such as the accessibility of various places on the inner or outer surfaces, the presence of different types of structural members which can hinder inspection, and the like. Regulations contribute to standardization of equipment or at least promote adherence to general pinciples in its design.

Compared with external inspections, internal inspections have the advantage of greater accessibility of the places to be tested, since they are directly exposed under operating conditions. However, radiation must be largely excluded from the interior of the vessel.

The first remote-controlled system for interior inspection was a device used for the Elk River PWR [pressurized water reactor] pressure vessel (1963).

The equipment used for internal inspection of the Oskarshamn BWR [boiling water reactor] and other BWR's in Sweden is a remote-controlled system which was designed in cooperation with SwRI (Southwest Research Institute, United States) and the Swedish TRC Corp (Tekniska Rontgen-centralen, AB).

The system consists of six main components: a circular positioning device, a remote-controlled television system, equipment for the access port, special equipment for pipe connections, and a device for testing longitudinal welds on the cover.

A precisely turnable overhead traveling crane with rotary, longitudinal and vertical movement is used. It can carry the ultrasonic module, the television camera, the connector inspection equipment and other machinery necessitated by the internal fittings of the reactor.

The ultrasonic module was designed to pass through and operate in a 55-mm circular ring between the thermal shield and the reactor wall. It has one fixed and two remote-controlled variable-angle transducers.

[Figure 19 omitted]

The remote-controlled television system is mounted on a pole which passes through a swivel mechanism inside a circular positioning device. The swivel mechanism allows the pole to be moved vertically, rotated, or swiveled up to 10°. At the bottom end of the pole is a tilting frame which is used to move the camera. At the front of the camera are a remote-controlled turnable mirror and an illumination system, so that the direction of observation can be turned at will. The camera has a 1-2" or 1" objective for normal observation and a 3" objective and extensible tube for magnification.

The device for inspection of the outlet connector is moved within the connector by a positioning device which allows rotation and remote-controlled adjustment of the probe angle for successive analysis of the welds between the connector and the tank and the connector and the piping. Special connector equipment is used for inspection of the connectors. The complex geometry of the connectors requires careful adjustment of the probe angle.

The device for testing welds between the flange and the vault of the cover is designed for interior inspection of the circumferential welds in the cover. It uses a rotating pin in the bearing of the port in the cover, connected by a frame to the head; the probe angle can be adjusted.

The pole-mounted REML positioning device is used in England. The pole can be used to position the inspection instruments within ±4 mm for repeated inspections. This accuracy is achieved by the use of indexing equipment and recording of the readings from this device together with the inspection results.

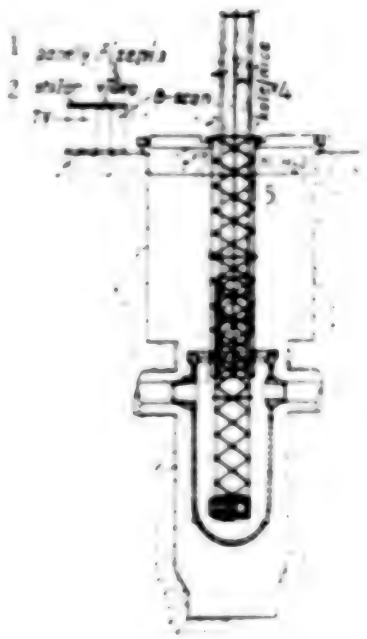


Figure 20. REML Pole-mounted Positioning Device

Key:

1. Control panel
2. Pole
3. Video
4. Track
5. Water level

The carrier components can be adjusted for different-sized vessels. The pole can be rotated around its axis and can be moved in the vertical and x and y directions. The inspection equipment is mounted on the pole and can be moved independently by manipulators. For example, in observing a connector, the ultrasonic head can be rotated around the connector bore, while a monitoring closed-circuit television camera can be used to check the operations. Similarly, in the case of the main welds of the pressure vessel, the television camera observes the weld areas undergoing ultrasonic testing. The testing results are recorded on videotape. This allows simultaneous recording of the ultrasonic test results, a television image of the location being tested and the indexing system. Thus all relevant data are given together, allowing a comparison of the results obtained in successive inspections.

The MAN Corp (Maschinenfabrik Augsburg-Nurnberg) has developed a positioning device with a rotary pole mounted on a fixed platform above the reactor for use in remote-controlled interior inspection of pressure vessels. On the pole are mounted an arm which holds the manipulators and the heads used to inspect the walls of the vessel, its spherical bottom and the connectors.

Rotary movement of the pole, translational movement of the manipulators along the pole and manipulation of the probes are conducted from the platform. The company developed the Tatzelwurm multiprobe ultrasonic equipment for this equipment in cooperation with the Krautkramer Corp.

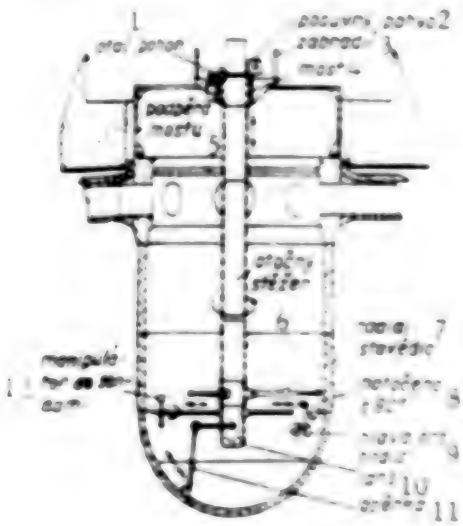


Figure 21. Pole-mounted Positioning Device of MAN System

Key:

1. Rotary drive
2. Translational movement
3. Barrier
4. Bridge
5. Bridge support
6. Rotary pole
7. Radial interlock
8. Rotated through 90°
9. Head for connector
10. Cable
11. Stop

The equipment assumes a pressure vessel without its internals and is adaptable to various vessel dimensions. It was tested in a 600 MW nuclear power station in 1970 and is in use in nuclear power stations in the FRG and Switzerland. Its purchase for monitoring VVER-440 reactors in Czechoslovakia is under consideration.

A multipurpose device designed in accordance with the specifications of the ASME Code, Section XI, for ultrasonic interior inspection of pressure vessels with the cooperation of SwRI is being sold by PaR (Programming and Remote Systems Corp).

The device is described in detail in U.S. Patent No 3,780,571 (1973) and is shown in Figure 22. It contains a supporting structure in the form of a telescoping pole which can be removed from the vessel and reintroduced in the same position to allow comparative inspection. The supporting structure holds manipulators with ultrasonic probes, television cameras and the like and is movable in various directions, allowing operation in all spaces within the vessel. The position of the inspection complex and all movements are coded.

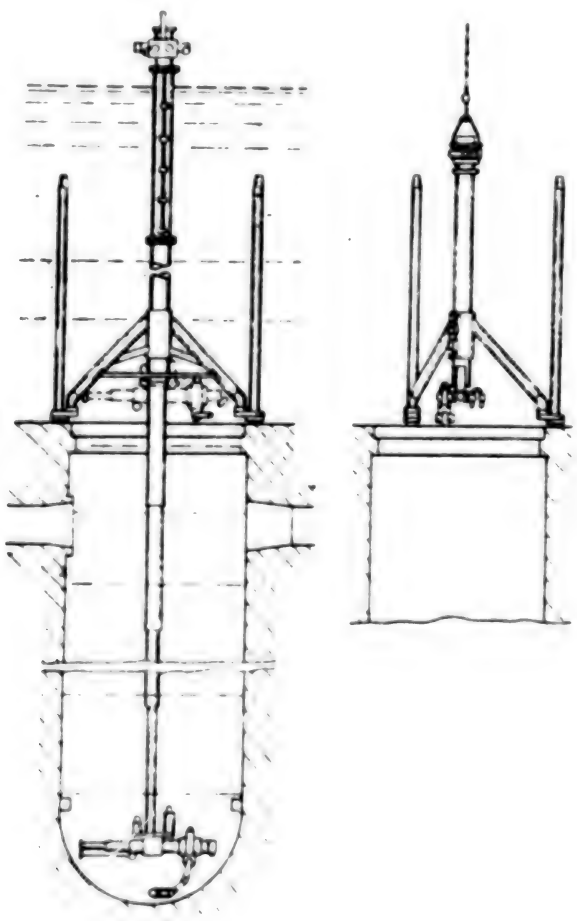


Figure 22. Positioning Device of PaR System

This device allows remote inspection of all welds in the reactor vessel, including those in the spherical bottom, with the exception of piping intended for instruments within the core. The system has high dynamic stability and rigidity in order to allow repeated inspections (reproducibility to within several millimeters), is remote-controllable under water and in a contaminated environment, can be adapted to various types of pressure vessels, hand manipulation and automatic machine processing of the data, and is simple to decontaminate, install, dismount and transport.

Initially, installation and preliminary testing of the system and a complete inspection of the pressure vessel required only 9 days.

Another device for remote interior ultrasonic inspection of pressure vessels in accordance with ASME Code, Section XI, was designed by the PWR-SD section of the Nuclear Service Department, Westinghouse Corp, for PWR reactors which it produces.

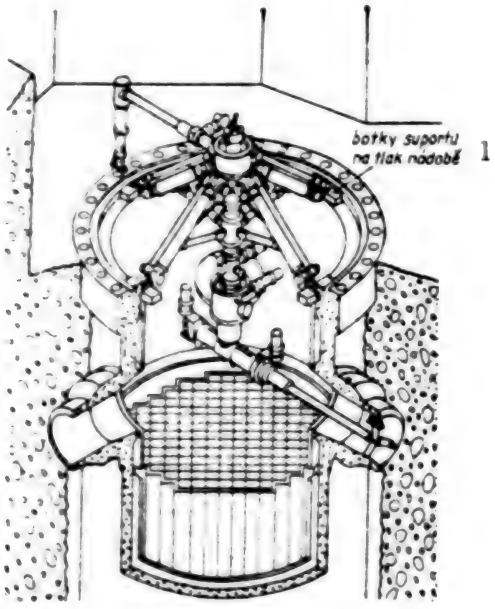


Figure 23. Westinghouse System Positioning Device

Key:

1. Support shoes resting on pressure vessel

The principal structural components of this device are the head system and the central support system, both stationary, on which a variety of mechanisms can be installed. The head system, of umbrella-shaped design with four uncoiling arms, is mounted in its basic position on the inner flange of the pressure vessel by means of shoes. The support system and its guide channels and the two manipulator arms can be extended 10 inches. These rigid elements assure an unchanging position of the equipment better than a telescopic device. The movable part of the equipment consists of the manipulator arms,

which carry sensing equipment for ultrasonic inspection of the vessel, flange and connectors. Electric drive is used to rotate or extend the arms on the support, while the telescoping movement of the manipulator arms is done pneumatically. Position indication is carried out by an optical coder directly linked to the corresponding drive mechanism. The basic design is adapted to pressure vessels measuring from 120" to 180" in diameter, while the telescoping manipulator arm is designed for connectors with diameters of 27" to 36". The device is built primarily of stainless steel and structural aluminum. It is easy to transport, install and service. Some operations can be carried out without removing the reactor internals.

The Japanese MHI corporation has developed a remote-control device for in-service inspection of PWR pressure vessels which uses a rotating elevator pole which carries manipulators with ultrasonic probes. The equipment consists of a mechanical section, which operates underwater in the reactor vessel, and a control panel.

The design of the mechanical components allows them to be mounted on the upper flange of pressure vessels of various diameters (internal diameter 3,300 to 4,420 mm, maximum depth 7,400 mm, maximum internal diameter of connectors, 690-900 mm) and allows the manipulators to be positioned in specific locations with great precision and reliability (±3 mm vertically, ±2.5 mm at right angles). The control panel allows both manual and automatic operation of the mechanical components. The design allows for the effects of the water column pressure, radiation and corrosion of the main components of the mechanism.

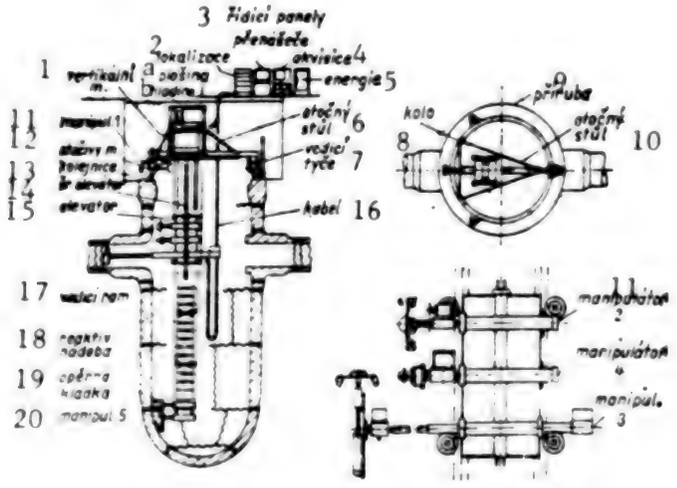


Figure 24. MHI System Positioning Device

Key:

1. Vertical bridge
2. Location
3. Transducer control panels
4. Acquisition
5. Power
6. Rotary table
7. Guide rod
8. Wheel
9. Flange
10. Rotary table
11. Manipulator
12. Rotary platform
13. Track
14. Elevator screw
15. Elevator
16. Cable
17. Guide arm
18. Radioactive vessel
19. Support roller
20. Manipulator
- a. Platform
- b. Water level

In addition, for the inspection of certain critical locations within the pressure vessels of previously constructed reactors, specially designed manipulators involving the fueling mechanism have been designed.

External Inspection of Reactor Pressure Vessels

External inspection of the reactor pressure vessel requires free access to its surface for the inspection equipment and sensors. This inspection may be conducted without removing the reactor cover and has the advantage that it reduces many anomalies resulting from the use of stainless steel linings.

In essence the inspection equipment is moved down tracks welded to the pressure vessel or held against it by a magnetic mechanism. Each welded-on lug must, of course, be installed before eliminating the residual stresses during production of the pressure vessel.

Installation of the equipment requires a suitable gap ($\sim$ 200 mm) between the pressure vessel and the biological shield and a constant water feed to the probes to assure acoustic coupling. Several systems have already been developed for external inspection, but to date they have been used less than equipment for interior inspection. The MAN Corp has produced equipment for a 600-MW BWR with a vertical guide track magnetically held against the reactor vessel, along which travels a dolly with a flat model Tatzelwurm ultrasonic probe.

For inspection of BWR's, Babcock and Wilcox Corp has developed a system consisting of six encircling tracks at the upper and lower sections of the pressure vessel and a vertical connecting element which moves around the vessel. The ultrasonic module travels along this element (see Figure 25).

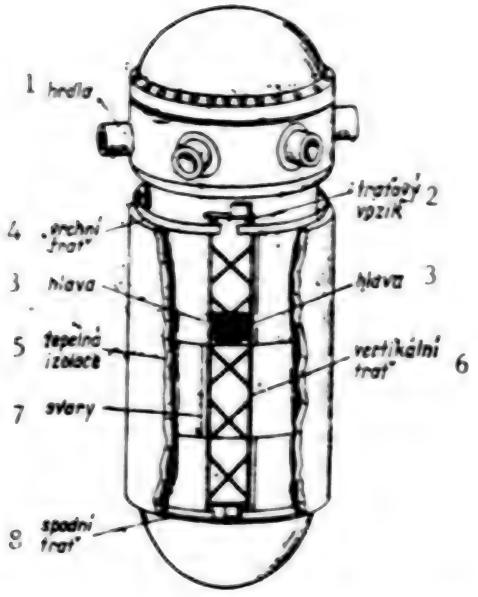


Figure 25. Babcock and Wilcox Internal Inspection System

Key:

1. Connector
2. Track dolly
3. Head
4. Upper track
5. Heat insulation
6. Vertical track
7. Welds
8. Lower track

Similar equipment has been developed by Automation Industries, Atomics International, and Skoda n. p. [national enterprise], in the last-mentioned case for inspection of the pressure vessel of the A-1 reactor.

SwRI has developed several systems for external inspection:

--Inspection of the most exposed circumferential and vertical welds of the pressure vessel of the Atucha PHWR [pressurized heavy water reactor] in Argentina is performed by a device which uses shafts below the reactor and consists of a rotating support structure which carries a vertical ladder along which an ultrasonic module with three probes travels (Figure 26). A similar manipulator with a telescoping pole has been designed for inspecting the cylindrical parts and bottom of the vessel of the VVER-1000 reactor.

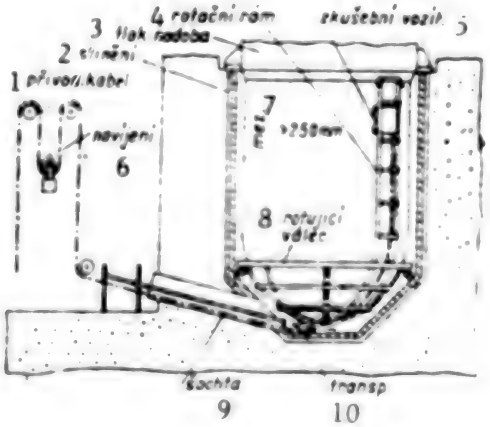


Figure 26. SwRI System for Inspecting Pressure Vessel of Atucha PHWR

Key:

1. Drive cable
2. Shielding
3. Pressure vessel
4. Rotating arm
5. Test dolly
6. Pulley
7. Gap
8. Rotating cylinder
9. Shaft
10. Transporter

--The Unipole device has been delivered for installation at several PWR's in the United States.

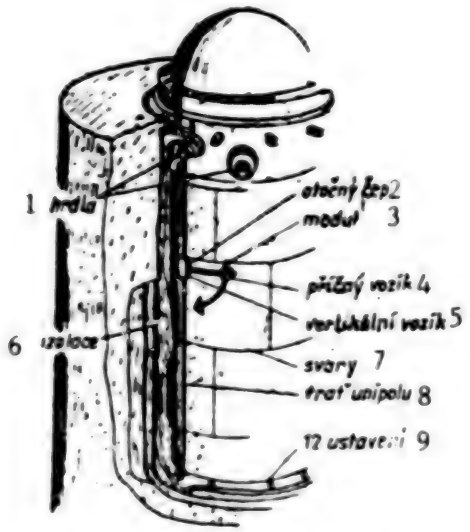


Figure 27. SwRI Unipole System

Key:

1. Connectors
2. Rotary pin
3. Module
4. Horizontal dolly
5. Vertical dolly
6. Insulation
7. Welds
8. Unipole track
9. 12 lugs

The ultrasonic module is moved vertically by a drive unit with 12 vertical tracks ("unipoles"), while it moves circumferentially on a short arm at right angles to the unipole track. An accessory to this equipment is a device for external inspection of the hemispherical bottom of the pressure vessel, as shown in Figure 28.

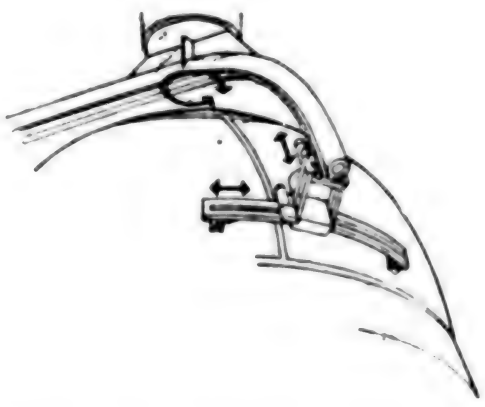


Figure 28. Device for Interior Inspection of Bottom

--The so-called "Magnetic Mouse" system has been developed for inspecting the pressure vessel welds of the Peach Bottom 2 and Fukushima 2 BWR's. This is an instrument dolly carrying the ultrasonic probes, which travels along the surface of the vessel on treads 100 mm wide.

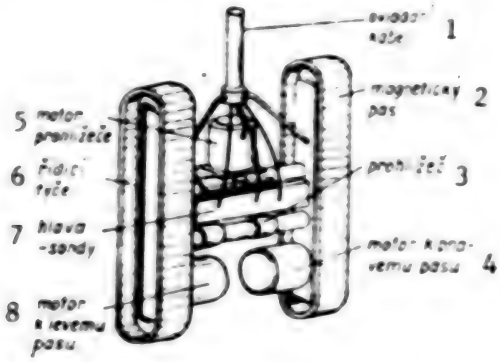


Figure 29. Magnetic Mouse System

Key:

1. Control cable
2. Magnetic treads
3. Probe
4. Motor right tread
5. Probe motor
6. Control rod
7. Probe head
8. Motor for left tread

--The "Pipe Car" system was used for inspecting the welds on piping with a diameter greater than 250 mm. Pretensioned leaf springs hold the track for a dolly, which carries an ultrasonic module and drive unit, around the pipe (Figure 30).

[Figure 30 omitted]

The General Electric System (Nuclear Energy Division) was developed for ultrasonic testing of cylindrical parts and areas of pressure vessel tubing. The ultrasonic unit is transported along the exterior surface of the unit by a device equipped with magnetic rollers. The system is guaranteed to adhere to the surface up to a surface finish of 25 to 50. Position is determined by a television system by triangulation on two fixed points on the vessel surface. A third component is an accessory gravitational system. The mechanical system has control and evaluating electronics.

The company does not offer this equipment for sale, but provides service in accordance with the requirements of the ASME code, Section XI.

The Sonolog vessel scanner, produced by the RTD Corp (Roentgen Technische Diener, Rotterdam), is a mechanized ultrasonic system for inspection of pressure vessels which consists of a measuring bridge and a Sonolog 76 control system. The measuring bridge has two tracks on the outer surface of the vessel and a transverse carrier with an ultrasonic multiprobe. The surface area that can be tested at one clamping of the bridge is 2 x 2 meters. With simultaneous recording of the results, the maximum testing speed of the multiprobe is 150 mm/sec, while the reproducibility is ± 2 mm. The results are read out rapidly in plural analog or facsimile form.

10. Safety Organizations and Regulations

In the first nuclear power stations, little attention was given to inservice inspections and the corresponding regulations, because the reactors were not sufficiently accessible owing to radioactivity and it was assumed that the components of nuclear systems were designed, produced and operated with higher quality than those of conventional power stations.

For example, the pressure vessel of the Czechoslovak A-1 reactor was produced at a time when the world's first standards and regulations intended to assure reliability and safety of nuclear power stations were just being developed. The A-1 project did not provide for inservice inspections of vessel integrity; but so-called "evidentiary" samples of the pressure vessel and weld material were provided, and such inspections and tests as were possible given the condition of the installation were planned for the period of operation. The decisive factor in these inspections was the inaccessibility of the interior of the vessel and the limited access to its exterior. In the accessible locations, a method similar to that used in preoperation testing, which was specific to that individual location, was used.

A fundamental change of direction in respect to standards and regulations aimed at assuring the quality of nuclear components was the issuance of the ASME Code, Section XI, and standardization at the international level by the IAEA [International Atomic Energy Agency].

The ASME Code, Section XI, "Inservice Inspection of Nuclear Reactor Coolant Systems," resulted from the cooperation of a statutory organization (ANSI [American National Standards Institute]), the U.S. Atomic Energy Commission (now the NRC [Nuclear Regulatory Commission]) and the nuclear industry. Work began in 1967 and resulted in issuance of the first edition in 1971.

The most important characteristics of the code are:

--the conceptual design of nuclear reactor cooling systems must allow inservice inspection under radiation conditions and possible replacement or repair;

--requirements regarding the testing of components before startup are specified as an initial basis for subsequent inservice inspections;

--new inspection systems or methods better suited to remote-control applications will be approved if they appeared promising;

--the schedules and scope of inspections for individual components or sets of components were specified in terms of estimated probability of occurrence and significance of failures and malfunctions with respect to system safety.

The basic requirement of the code is the performance of planned preoperation and inservice inspections. It defines the limits of the system to be inspected. It does not require inspection for components outside these limits, while those within them must fully meet code requirements. Certain limits on their stringency apply for components which are not subject to coolant loss during operation. The inspection space must allow access for personnel and inspection equipment to the locations to be inspected. Currently the code allows three categories of testing methods for inspections: visual, surface, and volumetric, as discussed previously. The code deals primarily with the individual cooling circuit components of nuclear power station cooling circuits during their planning, design, production, construction and

operation. It is a living regulation by which producers, operators and authorizing bodies assure trust in system integrity. Additional alterations and changes have been made in the first edition and it is expected to be supplemented, e.g., for systems other than light-water systems.

The ASME Code, Section XI, is thus a model for similar regulations in various countries.

Most European countries have an organization with jurisdiction and responsibility for carrying out inspections. In England it is the NII (Nuclear Installation Inspectorate), which since 1975 has been under the Health and Safety Executive; in France it is the Institut pour la Surete Nucleaire; and in the FRG, it is the Institut fur Reaktorsicherheit, which is a joint organization of the federated Laender. These bodies, under pressure from the public and experts, are gaining importance and independence, and industrial companies are obliged to meet their requirements. Naturally this has considerably increased administrative costs in the construction of nuclear power stations.

The Soviet regulations which must be taken into account in adopting and using nuclear equipment under license include the following.

--regulations for construction and safe operation of the equipment of nuclear power stations and experimental and research reactors and systems, issued on 20 April 1972;

--regulations for testing of welded joints and welded components and members of nuclear power stations and experimental and research reactors and systems, PK-1514-72, issued 15 March 1974;

--according to the regulation "Regulations for Safety of Research Reactors," part of the "Nuclear Safety Regulations," the individual components of a research reactor and its experimental equipment which might affect nuclear safety must be subjected to detailed testing during production, installation and startup and periodic tests during operation.

On 20 November 1970, the GDR approved "Labor Safety Regulation 880, Construction of Nuclear Power Stations With Pressurized Water Reactors," which primarily involves technical and safety principles for the planning, production and installation of equipment for nuclear power stations with pressurized water reactors.

The current Czechoslovak regulations on nuclear safety in design, contracting and performance of construction projects involving nuclear power equipment is Order No 2 of the CSKAE [Czechoslovak Atomic Energy Commission] of 27 October 1978.

Notice No 6 (9 January 1979) of the Czech and Slovak Labor Safety Office establishes the requirements for state expert oversight over selected pressure components of nuclear power station equipment. In addition, CSKAE has issued various requirements and instructions, including safety criteria for assuring

quality, in a UISJP [?Central Information Service Publishing House] publication, "Bespecnost jadernykh zarizeni. Pozadavky a navody (Nuclear Equipment Safety: Requirements and Instructions)."

Thus far Czechoslovakia has no regulations and corresponding state standards for periodic inservice inspection of primary circuits. An effort is being made to introduce them as a unit in connection with a CEMA project.

11. Conclusions

The highly ramified problems of periodic inspection of pressure systems in nuclear power stations have been discussed in detail, particularly in numerous reports of specialized conferences and seminars.

Through a study of this extensive literature, we have tried to give in this paper a multisided presentation of the topic of inservice inspection, focused primarily on nondestructive testing methods. It will be extremely beneficial to compare this multisided presentation of the current worldwide situation with the actual situation in Czechoslovakia.

8480
CSO: 2400/147-A

CSN DOCUMENT OUTLINES OBJECTIVES OF NUCLEAR PROGRAM

Brasilia CORREIO BRAZILIENSE in Portuguese 6 Mar 83 p 20

[Article by economics editor Roberto Hillas]

[Text] The Brazilian-German nuclear agreement is not going to be revised nor will some of its more controversial aspects be reviewed; the planned installation of the lightly enriched (by 3 percent) uranium fission electronuclear plants of the Angra 1, 2 and 2 type will proceed. The certainty that that is what is going to happen is manifested in the document "Observations on Brazilian Nuclear Policy," drafted by the National Security Council and forwarded this week to the leaders of the Social Democratic Party (PDS) in congress by General Danilo Venturini. According to the document, the agreement will be maintained in order to guarantee the complete transfer of the technology programmed.

This important document, which outlines the party's policy of defense of the nuclear agreement with the Federal Republic of Germany (FRG), also reveals the great changes introduced into Brazilian nuclear strategy, now no longer tied to the agreement. One of the changes pertains to the more complex portion of nuclear technology, the so-called fuel cycle, involving the enrichment of uranium to transform it into the energy vector, the manufacture of the fuel element with that same enriched uranium, and the reprocessing of the enriched uranium after it is spent to obtain the precious plutonium.

The document makes it clear that the agreement is now only a part of the nuclear program, which is going to seek its own alternative technologies simultaneously. For that purpose, the country's scientific and technical communities are going to be activated with a view to the development of technologies such as that of uranium enrichment. Without specifying, the document states that the program must be based on the "maximum utilization of the capabilities existing in the country" and in the "incentive to intellectual creativity with a view, first of all, to the generation of national alternatives to imported technology."

The Brazilian nuclear porgram, therefore, ceases to be the exclusive responsibility of a few and becomes democratized, leaving the closed context of the offices of the National Security Council, the Armed Forces General Staff, the War College (ESG), the National Nuclear Energy Commission (CNEN)

and the Brazilian Nuclear Corporation (NUCLEBRAS), and gaining new terrain, a new dimension. The document advocates "encouraging the participation of the Brazilian universities" in conducting the program, explaining also that "decentralized execution" [of the program] will also be adopted. For that "decentralized execution" universities and related industries will be activated.

The CSN document also explains that the effort underway is going to be based on "the definition of priorities in view of current and future national interests with a view to economic and social development." It, therefore, establishes the precedent that yesterday's priorities in terms of nuclear energy may no longer be the today's priorities, just as the current priorities may become superseded by a new future situation. Therefore, at the present time, the priority of the nuclear program is no longer only the transfer of technology from the FRG; a new, parallel priority now exists, namely, that of research aimed at more advanced technologies.

The same document is quite clear with reference to the political interests implicit in the Brazilian nuclear strategy, in the Brazilian nuclear program, which among other objectives to be attained are "to enable Brazil to become an exporter of nuclear technology." The nuclear technology that Brazil may absorb and/or develop will, therefore, henceforth become one more of the country's foreign policy instruments. The importance of the country's scientific and technical communities for the research and development of nuclear engineering becomes evident.

The nuclear strategy reformulated by the CSN calls for Brazil to equip itself to transfer nuclear cycle technology to the potential customer-states almost all of them in the Southern Hemisphere, among which may be listed large oil producers such as Algeria, Libya, Nigeria, Venezuela and others. Therefore, the diversification of research toward, for example, the enrichment of uranium either through the predictable gaseous diffusion system or ultra-centrifugation is perfectly foreseeable in a very short time. It is obvious that Brazil will no longer wait for the possible economic feasibility of the FRG's enrichment system utilizing centrifugal jets.

The strategy was modified, modifying the program, because Brazil has changed and the world has changed, and even nuclear research has evolved toward new, more efficient options of generating energy. A determining factor for the change was the fact that there is in Brazil today a surplus of no less than 2.5 million kilowatts of electric energy generated by hydroelectric plants. A determining factor also was the evolution of the per-kilowatt cost of the electronuclear plants, today around $3,000. The program was ambitious in its beginning, calling for the generation of 75 million kilowatts of electro-nuclear energy by the year 2000 because it was formulated at the time when the electronuclear kilowatt cost only $400.

With reference to the financial aspect, there is no way of passing on the cost of such expensive electricity to the consumers. The problem of the concessionaires of the Brazilian Electric Power Stations Corporation

(ELETROBRAS) is going to be enormous with only the plants under construction and those anticipated. By the early nineties, they are going to have approximately 5.4 million electronuclear kilowatts at a price three times higher than the price of hydroelectric energy. What to do? In the opinion of ELETROBRAS economists, there is only one solution: subsidizing nuclear-originated energy. The electronuclear plants, therefore, represent a serious problem for the country's economic policy.

Since electronuclear energy is not competitive and Brazil adopts a capitalist economic system and a market economy, it is no longer possible to install 64 plants by the beginning of the next century as the former president of NUCLEBRAS, Paulo Nogueira Batista, planned to do. Without the changes imposed on the agreement with the FRG and on the nuclear program, how much would be paid per kilowatt of electricity? If it were now; if Brazil now had the number of nuclear plants planned by the year 2000, the residential kilowatt would leap from the current 5,525 cruzeiros to no less than 11,381.50 cruzeiros (it would increase 106 percent).

Furthermore, there are sufficient hydroelectric and anthracite coal resources to take care of the demand for electricity for a minimum of another 50 years. With the anthracite coal of Rio Grande do Sul and Santa Catarina alone, without counting the bituminous shale and peat in the rest of the country, it is possible to install a conventional thermoelectric park with a generating power of another 25 million kilowatts, the equivalent of 62.5 percent of the country's present electric energy generating power. That being the case, Brazil must, because it is sensible, adopt a plan for the construction of just enough electronuclear plants to absorb and/or develop know-how.

Electronuclear energy is also not vital to the economic survival of Brazil because the technology for the transmission of electricity over great distances has already made feasibl. the transmission of hydroelectric energy from Amazonia to the Center-South region, to the industrial parks responsible for the greatest consumption. Without that technology, there would be a shortage of hydroelectric energy from Sao Paulo to the South by the next decade if the transfer of industries to Amazonia and the Center-West were not encouraged. Now with direct-current transmission capability, there is no longer that need to be supplied by electronuclear plants.

A determining factor also for the change in nuclear strategy was the determination of the fact that the nuclear reactors now in use in the world of the type adopted by Brazil, represent the inefficient use of uranium reserves, which are scarce (Brazil has 301,490 tons of natural uranium, equivalent to 45,216 tons of enriched uranium, enough to operate 38 electronuclear plants for 30 years--(their useful life). With the fast-breeder reactors of the plutonium-uranium 238 cycle and the thermal superconverters of the thorium-uranium 233 cycle, for example, the utilization of the fuel is efficient.

For that reason, the Brazilian nuclear program is seeking to activate fast-breeder research which will make it possible for the Brazilian uranium to be sufficient, theoretically, to operate 226 plants with a generated power of

1.3 million kilowatts each. With these plants, the cooler for which is already being researched together with Italy, it is possible to multiply by 60 the energy power of the Brazilian uranium reserve. This efficiency, being sought by powers such as the United States and the Soviet Union was an influence in causing good sense to bring about a change in Brazilian nuclear strategy.

8711
CSO: 5100/2048

BRIEFS

NUCLEBRAS DISMISSALS END--Brasilia--The president of the Brazilian Nuclear Corporation (NUCLEBRAS), Dario Gomes, asserted yesterday that dismissals from the NUCLEBRAS Heavy Equipment Corporation (NUCLEP), which has just released 252 employees including 12 German engineers, have been suspended. He maintained also that there will not be any cuts in NUCLEBRAS itself and its subsidiaries and said that additional dismissals of personnel have also been suspended. He declared that when NUCLEP is again in a position to contract personnel, the employees dismissed will get preference, with the exception of the Germans, because he believes that they can be replaced by Brazilians who were trained in Germany. Dario Gomes explained that the dismissals from NUCLEP stem from adjustment of the nuclear projects to the shortage of funds, which resulted in suspension of the beginning of construction of Iguap-I and II, which was scheduled for this year, and the 1-year postponement of the entrance into operation of Angra-II and III. With the reduction of the pace of those projects, the president of NUCLEBRAS explained that the orders for equipment from NUCLEP have diminished. Gomes denied the reports about the deactivation of NUCLEP. He said that he has never thought of adopting that measure and that he does not know the source of those reports. He also made it clear that there will not be any replacement of the directors of the nuclear subsidiaries and even justified the presidential decree that renewed the contracts of all the directors of NUCLEBRAS for another 5 years. "The reconfirmation of the directors is the best way to give continuity to the activities of the company," he said. [Sao Paulo O ESTAO DE SAO PAULO in Portuguese 12 Mar 83 p 23]

KWU ON RESCHEDULING--Sao Paulo--The timetable for the production of equipment for the Brazilian nuclear program by Kraftwerk Union (KWU), a subsidiary of Siemens Ag of Germany, has already been rescheduled. There will be a 1-year delay in the construction of the Angra-II and III nuclear plants in Rio. The report came from the chief executive of Siemens of Brazil, Helmut Vervuert. He added.that KWU has already adapted to the new timetable deciced by the Brazilian Government (which "is sovereign with reference to the nuclear program"). Vervuert, who attended a luncheon at the Brazilian-German Chamber of Commerce and Industry of Sao Paulo, revealed that Brazil's position stems from the economic-financial problems it is facing and that it will take at least 2 years for the economy to return to normal. However, even after normalcy is achieved, according to him, one should not expect a return to a 10 percent growth per year for the economy. The Brazilian economy can grow a

maximum of about 5 percent per year. That is the most the savings of the country permit in terms of growth, explained Vervuert. Asked about the flight of German investments from Brazil, Helmut Vervuert said: "Nobody is investing, not even Brazilian national private enterprise. Everybody is waiting. As you can see, the reduction of investment in the country is not a privilege of German companies. I believe the reduction is general at this time." [Rio de Janeiro JORNAL DO BRAZIL in Portuguese 4 Mar 83 p 24] 8711

CSO: 5100/2048

LAGUNA VERDE NUCLEAR PROJECT BADLY BEHIND SCHEDULE

Mexico City EXCELSIOR in Spanish 26 Feb 83 pp 1-A, 12-A

[Article by Fernando Meraz]

[Text] Laguna Verde, Ver., 25 February--Today, 20 years after it was started at an estimated cost of 2 billion pesos, the nuclear electric power plant at Laguna Verde--the first Mexican nuclear project--has already cost more than 80 billion pesos, without even having advanced to the half-way point; now, because of the economic crisis which seems to be dragging on without precise end, it looks like a mirage.

The history of Laguna Verde is a big lesson in failures, corruption, and betrayals which moved the project along an erratic line to a swamp without any outlet; it furthermore makes it impossible for the country to confront the exhaustion of its petroleum resources by the end of the century and at the same time the country is paralyzed in its efforts to switch to nuclear energy. Today, the colossal plant, built of steel and concrete structures but unfinished, stands as a monument to ineptitude.

The unfinished buildings moreover are deserted. Budget austerity has forced the Federal Electric Power Commission into a series of successive layoffs which reduced the personnel force from 15,000 to 3,000 workers; in November, 4,000 workers were dismissed. This was followed by 3,000 and finally another cutback of 2,500. Under these conditions, the project is in fact paralyzed indefinitely.

But what actually did happen at Laguna Verde?

Here is the answer from engineer Elias Daguer, the project control chief; engineer Ernesto Zavaleta, the general construction supervisor; engineer Sergio Valverde Azpiri, chief of engineering and construction, engineer Gerardo Carballo, deputy chief for project control; and engineer Carlos Espino, an official at the information center.

The plant's construction began at the end of the decade of the 1970's, during the administration of President Gustavo Diaz Ordaz. It was realized that Mexico must join in the development of nuclear science and the latter would

have to be adapted for practical purposes in order to cope with the future. Thus we began to draft the project and to invite the chief manufacturers and engineers in this field to submit competitive bids. But then came the first setback: The change in administrations which made it necessary to postpone the competitive bidding.

Echeverria Supports the Project

At the start of the administration of President Luis Echeverria, the latter restated his support for the project, authorized competitive bidding, and finally gave the "green light" to launch the project through the following enterprises: General Electric, of the United States; and Mitsubishi, of Japan; they were responsible for the nuclear part; the engineering portion was contracted out through the Industrial Office of Mexico to Burns and Row who began work in 1974 amid great pomp. The second setback came just 2 years later: The 1976 devaluation which stopped activities for a year until the contracts were renegotiated.

When the undertaking was resumed in April 1977, the Federal Electric Power Commission reviewed the contracts and discovered a series of irregularities among the contractors of the Industrial Office and their United States and Mexican middlemen. Almost 10 years after the start, the project had achieved 6 percent progress. Then the Federal Government decided to cancel the Burns and Row contracts to transfer them to EBASCO. During the discussion among the contractors, there arose a new dispute which stopped the project for almost 6 months.

On receiving notification of the project's cancellation, Burns and Row gave assurances that they were turning the job over with a progress figure of 40 percent; EBASCO, which took the project over, determined 25 percent progress; the project as a whole only showed 6 percent progress. "We learned a lesson from that," said Engineer Daguer rather ironically, "and that was that the optimum degree of progress in any project of this kind is 60 percent and that you should not get less."

By that time, under the administration of Lopez Portillo, we had the happy years of the petroleum bonanza. EBASCO worked better; the Federal Electric Power Commission, directed at that time by Hugo Cervantes del Rio, managed to negotiate an agreement which, within 3 years, brought 27 percent progress; besides, a new philosophy took hold thanks to which the project developed in a coordinated fashion between the Mexican side and the United States builders, involving real technology transfer.

Another Setback

But a new setback took place at that time: The Secretariat of Patrimony and Industrial Development sent the Congress its draft of the Law Regulating Article 27 of the Constitution dealing with nuclear fuels. This produced a national wave of nonconformity since the law, drafted by engineers, such as Fernando Diriart and Dalmau Costa, left some dangerous gaps regarding the exploitation of uranium deposits which--according to the order--could be awarded

on the basis of concessions to transnational corporations. The Union of Nuclear Industry Workers, headed by Arturo Whaley and Antonio Gernsenson, with the support of all the independent labor unions and the left-wing party, managed to get that law amended, in spite of the opposition of Secretary Andres Oteyza.

But this once again caused a delay at Laguna Verde. On top of that, the United States by that time had declared an embargo on uranium which Mexico had sent to that country to supply the reactors of the plant, arguing that Mexico lacked the safety systems that are indispensable in handling nuclear materials. Due to the haughty attitude of Secretary Oteyza, this became a new problem which triggered another nationwide debate as to whether Mexico should use enriched uranium for the reactors at Laguna Verde, as had been planned, or whether they should use natural uranium whose technology was offered by Canada under better conditions.

Right now, the plant, which has been planned for a generating capacity of 1,300 Mw, equivalent approximately to 6 percent of the energy currently being generated in the country, shows 60 progress in the first unit and 40 percent in the second unit, with a total physical progress of 45 percent, approximately.

And when will it be finished?

The answer comes from Engineer Daguer: "Right now, it would be impossible to guess. As of this moment, the project is under review by the Secretariat of Energy and Mines. The budget has not yet been figured out and, so long as it is not final, we will not know what we are supposed to do. The only thing we know is that it will be much less than in earlier years. But so long as the budget is not drawn up, we will not know what to do."

The Secretariat of Energy and Mining has the following three real alternatives: 1. Continue with a determined advance of 100 percent to finish the job by the middle of the 6-year term which would require an investment of 10.5 billion pesos; 2. Maintain a critical degree of progress which would make it possible to finish the job by the end of the six-year term, with a required allocation of 8.5 billion pesos; 3. Paralyze the nuclear project and keep progressing only in the engineering part which would require a budget allocation of 4.5 billion pesos.

In the meantime, the country keeps falling behind, time is running out. Mexico is approaching the end of the century without knowing how to cope with the switch to nuclear power. What is the result of all this?

The Apocalypse.

5058
CSO: 5100/2050

GANDHI COMMENTS ON SOVIET NUCLEAR OFFER REPORTED

Bombay THE TIMES OF INDIA in English 4 Mar 83 p 13

[Text]

NEW DELHI, March 3.

THE Prime Minister, Mrs. Indira Gandhi, told Dr. Bhai Mahavir (BJP) in a written reply in the Rajya Sabha today that an offer by the Soviet Union to set up a 1000-MW nuclear power plant in India was being considered.

The Prime Minister said that an Indian delegation had just returned from the USSR after ascertaining various technical details of the offer. Based on the report of the delegation, the government will examine the offer from various angles before taking a final decision.

Mrs. Gandhi also said that there was no proposal to initiate global tenders to avoid controversy.

The Prime Minister told Mr. S. Shahabuddin (Janata) that India wanted to be self-reliant in its atomic energy programmes and did not wish to increasingly depend on imported heavy water.

She said there was an existing contract with the USSR for the import of 256 metric tonnes of heavy water and 125 tonnes of this quantity still remained to be supplied. The price had to be negotiated every year. There was no penalty clause for non-supply.

In another written reply to Mr. Shiv Chandra Jha, Mr. Shivraj Patil, minister of state for atomic energy, said that the Tarapur plant was being operated at a lower power level to stretch the available fuel.

UNI & PTI add:

NUCLEAR FUEL: All the nuclear power stations in operation or at present under construction in the country, except the Tarapur atomic power station, would use indigenous natural uranium as fuel, Mrs. Gandhi informed the house.

The capacity of the fuels division of the nuclear fuel complex, Hyderabad, was being expanded in a phased manner to meet the requirements of the nuclear power programme, Mrs. Gandhi told Mrs. Usha Malhotra (Congress-I).

HEAVY WATER PLANTS: The Prime Minister said that steps were being taken to optimise production at the existing heavy water plants by on-streaming procedures, timely and effective maintenance and effective operation.

Mrs. Gandhi told Mr. G. C. Bhattacharya that the reasons for shortfall experienced in the production of heavy water include reduced power availability, fluctuations in the deuterium content in the feed gas to heavy water plants, lower gas availability and technical problems in the plants.

The Prime Minister said heavy water production had been tried with four different technologies which were technically feasible and economically viable and two of these had been chosen for larger capacity plants.

Mrs. Gandhi said 547.6 metric tonnes of heavy water had been imported at a cost of Rs. 81.50 crores for the atomic energy programmes.

She said the failure of the ammonia cracker tubes in the heavy water plant in Tuticorin had since been rectified without any damage to the equipment. Further, there were only two incidents of any consequence in heavy water plants ever since inception—one at Mangal in 1982 and the other at Baroda in 1977. In the former case the fire was due to leakage of hydrogen from one of the valves on the high pressure system wherein in the latter, one of the injection blocks in the high pressure synthesis gas line gave way leading to fire and explosion.

CSO: 5100/7072

DEFENSE MINISTER COMMENTS ON PAKISTAN'S NUCLEAR EFFORTS

Calcutta THE STATESMAN in English 5 Mar 83 p 9

[Text] NEW DELHI, March 4.—Available information suggests that Pakistan is continuing her efforts to acquire uranium enrichment and nuclear fuel reprocessing capability which would enable her to detonate a nuclear device, the Defence Minister, Mr R. Venkataraman, told the Lok Sabha today, report PTI and UNI.

Pakistan has reportedly received assistance in the nuclear field from some countries, he said, in a written reply to a question on the making of an "Islamic bomb" by Pakistan.

Arms Production: Capacity utilisation in Ishapore Rifle Factory had declined to 33% because of demands for newer types of rifles, Mr Venkataraman said. He added that the capacity utilisation was expected to go up in the next three years, with the factory starting production of new types of rifles. Efforts were also being made to promote export.

Income-Tax Arrears: At least 30 top film stars, including Jeetendra, Hema Malini, Sanjay Khan, Rekha, Dara Singh and Vijaya Nirmala have run up income-tax arrears of more than Rs 1 lakh each. In a written answer, the Minister of State for Finance, Mr B. R. P. Pattabhi Rama Rao, said Jeetendra topped the list with arrears of Rs 34.88 lakhs, followed by Hema Malini with Rs 22.51 lakhs.

Pay Commission: The terms of reference of the fourth Central Pay Commission will be announced as soon as possible after consulting the representatives of the employees, Mr Pattabhi Rama Rao, said in a written reply.

RAJYA SABHA

River Talks: Utilization of water resources originating in Nepal was discussed when the Nepalese Prime Minister, Mr Surya Bahadur Thapa, visited India recently, Mr A. A. Rahim, Minister of State for External Affairs said.

Indians in Gulf Jails: The number of Indians jailed in the Gulf countries (excluding the United Arab Emirate) is 218, Mr Rahim said.

Gandhiji's Statue: A decision has been taken to install a statue of Mahatma Gandhi in the India Gate complex in New Delhi, the Deputy Minister for Works and Housing, Mr Mohammad Usman Arif, told Mr B. N. Pande in a written reply. The sub-committee on statues in the Parliament House premises has indicated that a statue of Jawaharlal Nehru may be installed in the Parliament House complex.

Employment Generated: A total of 235.39 million man-days of employment was so far reported to have been generated during the current year under the national rural employment programme, the Minister for Rural Development, Mr Harinath Mishra, told Mr B. S. Reddy in a written reply.

CSO: 5100/7073

EDITORIAL DEFENDS REPROCESSING OF NUCLEAR FUEL

Madras THE HINDU in English 24 Feb 83 p 8

[Editorial]

[Text]

INDIA'S REPROCESSING OF spent fuel obtained from the Rajasthan heavy water natural uranium reactors is a perfectly legitimate activity about which there is nothing surreptitious at all. It is true that this type of nuclear power system permits a higher rate of production of plutonium than, say, the Tarapur reactors which use low-enriched uranium. However, an international agreement ensures that any special nuclear material derived from the RAPP plants will be chased by IAEA safeguards that will apply in perpetuity. The reprocessing of RAPP spent fuel at the indigenously designed and constructed Power Reactor Fuel Reprocessing Plant (PREFRE) at Tarapur has been taking place (from November 1982) very much under the camera-eye of the International Atomic Energy Agency. The purpose — initially to gather experience in a highly sophisticated technical field and eventually to plough back the plutonium in a self-generating power programme — should be plain to any but a jaundiced eye. To build a campaign, as unnamed U.S. officials are doing through the columns of major American newspapers, on the charge that India is "stockpiling" plutonium to build 20 atomic bombs a year reveals either ignorance on an irresponsible scale or a mischievous attempt to reapply pressure on the independence of the country's nuclear programme. In the first place, while the so-called "nuclear option" can be said to be open to any havenot sovereign nation that has not signed the Nuclear Non-Proliferation Treaty, India's voluntary commitment to the exclusively peaceful uses of nuclear energy prevents it — so long as the national policy is not reversed — from manufacturing nuclear bombs of any kind. Secondly, unless the international agreement covering RAPP and its derivatives is repudiated, where is the question of diverting the safeguarded sensitive nuclear material for the purpose of making bombs?

Of course, there is a background to the U.S.-led external campaign against the self-reliant thrust of the Indian programme. The preoccupation with the PNE of 1974, and with the possibility of diversion from the civilian to a military (or military-related) use of the impressive capability and potential, has meant that the dominant purpose, that is concerned with the production of *nuclear power* in an energy-deficit country, has generally been missed. The post-NPT (post-1968) movement towards independence in the nuclear field and the posture that has, from time to time but especially after 1974, been interpreted as defiance, have attracted persistent efforts to place limits or restrictions of a type regarded by Indian public opinion as incompatible with the sovereignty of national decision-making. Those who have raised their voices against the country's nuclear energy effort, or have scolded it, have responded, typically, with extra-empirical and exaggerated assertions — leading at times to a ridiculous distortion of the policy issues. A notable case is the controversy relating to India's interest in the "back end" of the nuclear fuel cycle (which is defined in the non-proliferation literature as the sum of "the various actions that might be taken with respect to spent nuclear fuel" in contrast to the "frontend" processes of mining, processing, fabrication of uranium fuel elements and so on). An examination of the simple facts shows that India's commitment to the back end of the cycle — notably to reprocessing of the spent fuel, but also to a range from plutonium fuel fabrication facilities and the fast breeder to radioactive waste storage and disposal techniques — is a deep and integrated part of its nuclear energy programme and goes back to the Fifties. The "three stage fuel cycle strategy" on which the nuclear programme is predicated makes no sense without reprocessing of the spent uranium fuel. In fact, the 1963 Indo-U.S. agreement of nuclear cooperation made provision for the reprocessing of the low-enriched uranium fuel supplied to India as an integral part of the arrangement. Later, after the terms of the "non-proliferation" debate were changed unilaterally in the West, the U.S. attitude in particular has become obstructive. The objection to reprocessing and plutonium separation by the developing country with a non-nuclear-weapons status, but a relatively developed nuclear programme and PNE experience has been twofold: it has taken a general philosophical-programmatic stance against the activity and attempted to scotch it, and it has taken concrete expression in blocking the "joint determination" exercise in relation to the Tarapur spent fuel. From an Indian standpoint, the non-proliferation warriors in the U.S. Congress, within the executive branch and in the media have generally behaved as if reprocessing were a red rag, with "plutonium economy" and "fuel cycle State" evoking indefinable fears, prejudices and hostility. There is no reason whatsoever for the nation to oblige them by making any concession, including on the contentious matter of the reprocessing of Tarapur fuel.

CSO: 5100/7071

AEC CHIEF URGES SELF-RELIANCE IN NUCLEAR DEVELOPMENT

Calcutta THE STATESMAN in English 24 Feb 83 p 12

[Text] BOMBAY, Feb. 23--Dr Homi N. Sethna, principal Secretary to the Department of Atomic Energy and chairman of the Atomic Energy Commission, yesterday emphasized that India would have to plan and pursue its nuclear development activities based on self-reliance, even if it meant some disappointment and slow progress, while working towards the goal of non-discriminatory access to nuclear technology on a global basis.

Addressing members of the working committee of the All-India Manufacturers' Organization here, Dr Sethna clarified that he was not in favour of total self-reliance or antarctive development, since the entire history of science and technology had been an international endeavour.

But unfortunately, the rules governing nuclear technology transfer had been conditioned more by politics that by sound technological judgements, he said. That was why India needed to be self-reliant, he added.

Referring to the efforts or self-reliance in the field of nuclear power development, Dr Sethna said that there was some cause for statisfaction since India was the only one among the developing countries which had acquired capabilities in all aspects of the nuclear fuel cycle. H wever, the country could not afford to become complacent, he said, adding that what was urgently needed now was a rapid increase in installed nuclear capacity.

The long gestation periods needed to be cut down in order to speed up the programme, he said. In this respect, it would be advantageous to locate four reactor units at a given site to obtain full benefit from the extensive infrastructural facilities that needed to be set up for construction of a nuclear power station, Dr Sethna said.

He added that an indicative target of 10,000 MWE of nuclear power by 2000 A.D. had been considered by his department. To achieve this target, it was proposed to initiate construction of a number of 235 MWE units, to be followed by 500 MWE units in the '80s.

A matching increase in the production of uranium fuel and heavy water was also required. All of this would require adequate mobilization of the manufacturing industry for effecting timely supplies of components and equipment, Dr Sethna said

Talking about present difficulties, he said that the target of 10,000 MWE by 2000 A.D. might appear rather ambitious, but it should be remembered that even with this target the contribution of nuclear electricity would only be around 10% of the total electricity generated at that time, he pointed out.

Some people might have doubts about the wisdom of placing credence in nuclear energy, in the context of problems encountered at Tarapur or in Rajasthan. But, he stressed, these were pioneering ventures in the country and their operating record was no worse than the first few reactors built even in the advanced countries.

He said the process the country had gone through was inherent in the mastering of any new and complex technology and it was an inevitable price that one had to pay in effecting an early entry into this technology. The expertise and skills generated at these installations were bound to pay rich dividends in the next few decades, when the country would have to depend on nuclear power in a more significant manner, Dr Sethna said.

CSO: 5100/7070

BRIEFS

URANIUM FROM SEAWATER--The Prime Minister, Mrs. Indira Gandhi, told the house that studies conducted by the Bhabha Atomic Research Centre had revealed the cost of recovering uranium from sea water was rather high. The subject had been examined and reports on work carried out in different countries on the recovery studied by the BARC, she said in a written answer to Mr. Nanje Gowda and Putte Gowda. The requirement of natural uranium for nuclear power stations in the country was met and would continue to be met from indigenous production. The survey, prospecting and mining of uranium and fabrication of fuel, were planned to match the power programme, she said. [Bombay THE TIMES OF INDIA in English 24 Mar 83 p 6]

CSO: 5100/7069

ENERGY CRISIS: NUCLEAR ALTERNATIVE STRONGLY RECOMMENDED

Karachi DAWN in English 20 Feb 83 p 7

[Article by Mushtaq Ahmed]

[Text] **THE hypersensitivity of the superpowers to the proliferation of nuclear weapons stems from the potential threat to their monopolistic position in the balance of power. Whether or not they eventually succeed in warding off the threat, they can only retard and not thwart the movement for the peaceful exploitation of nuclear power, which is perhaps the only feasible alternative for surmounting a mounting crisis in the foreseeable future. The West itself is heavily relying upon it to meet its growing requirement of energy in the post-petroleum era.**

The irony of the situation is that the countries desperately short of energy are least capable of meeting the shortage because of their technological backwardness. The New Economic Order is already a still born child at North-South Dialogue and even the Old One must face a serious survival challenge posed by the disparity between resources and requirements of nuclear power. Figures paint a more grim picture of disparity than words can describe. The Third World comprising two-thirds of the world population consumes only [illegible] of the entire conventional energy and its share of the new source of nuclear energy is barely 5

Of the 527 reactors in operation, under construction or on order, 494 are located in the West and Japan, accounting for 374,041 MW out of a total of 399,087 MW capacity. Of the 40 countries using nuclear power, 31 are Western with the solitary exception of Japan from the East, nine are Asian or Latin American belonging to the developing states, six of them Asian and three Latin American.

Political bias

The Philippines, South Korea, Taiwan and India, have varying capacities of nuclear generation they are now striving to expand with the assistance of the West, and in the case of India, of the Soviet Union as well. Much as the West may deny a strong element of political bias in its hostility to Pakistan's nuclear programme, it is undeniable that politics is at the root of the assistance to the four countries in the nuclear list. Pakistan's need being all the greater, the posture of hostility is all the more regrettable. But for its persistence, our nuclear programme would have been in an advanced stage, and we would have been better equipped for the crisis which will deepen with the passage of time.

With only one reactor of 125 MW capacity, contributing only one-fifth of the total electric supply of Karachi, Pakistan does not figure on the nuclear map. It is the world's nineth most populous state, and yet its capacity does not compare favourably with states much smaller in population although they did not have a more favourable technological start. Brazil has a capacity of 5505 MW, South Korea 5398 MW, Taiwan 4960 MW, Mexico 1308 MW, the Philippines 502 MW and Cuba 410 MW. Japan's unsurpassed technological treasure has enabled it to generate more than half of its electricity from the nuclear source. Already the second largest user of nuclear electricity after the United States, it is hoping to raise its existing capacity of 21,385 MW to 51,000 MW by 1990 by the addition of 16 more reactors to its present inventory of 23.

A comparison with Japan is ludicrous. Of relevance to our conditions is the progress of technologically less resourceful countries which have accorded a central place to nuclear energy in their power programmes. India, for example, is planning to expand its nuclear base from 1994 MW to 10,000 MW by the end of the century. India is a large country but even a small country like South Korea is aiming at a much higher target of 30,000 MW. Brazil will have 10,000 MW, Taiwan and Mexico eight and four reactors each. Egypt too has an ambitious programme for the installation of eight reactors to generate 40 of its electricity by 2000 A.D.

The progress achieved by these countries in the field of nuclear energy must set at rest all doubts and fears in the developing world about its ability to forge ahead. It is a measure of the effort not merely to sustain their economies by making up the energy shortages through

new sophisticated devices but to further develop them by increasing the per capita consumption. Not all of them are in the same energy predicament as we are. Some of them like Taiwan and South Korea, have a very high per capita consumption level, and others like Mexico, have vast reserves of gas and oil, and yet, going nuclear is one of the major objectives of their national policies.

Looking into the future, after we have fully exploited all our resources of coal, gas, water and oil, self-sufficiency will still not be within our grasp. By the turn of the century our power requirements will have grown five-fold from the present 4400 MW to 20,000 MW if our development plans are to go through. Since our renewable and non-renewable sources cannot support this demand, recourse to nuclear energy in our case is an inevitable necessity. Pakistan must therefore get ready to face the technological challenge of the twenty-first century as the twentieth begins to fade into history.

We cannot avoid the nuclear option, specially when Pakistan is among the few countries endowed with uranium resources. Their total number is not more than fifteen, and in Asia it is one of the three. The fabrication of nuclear fuel from indigenous ore represents a breakthrough, demonstrating our capacity to feed our future nuclear plants. Several of our nuclear scientists and engineers are in the service of foreign governments for want of suitable avenues at home.

What is more there is an excess manufacturing capacity and a strong competition among reactor suppliers in the U.S.A., France, West Germany and Canada. These, unfortunately, have been the very countries from whose governments our nuclearisation plans have encountered stiff opposition in the past. The offer to place our nuclear programme under IEA safeguards and the readiness to sign the Non Proliferation Treaty provided India did likewise apparently did not conform to the dictates of their strategy.

Orly option

The tragic reality of the international situation is that your interests are often hurt by the pious intentions of your own allies. Nothing illustrated this reality more than American assistance to India which had exploded its nuclear device and when its laws did not permit the continuation of assistance, requesting France to act as its substitute, at the same time pressurising France to go back on its own commitment to Pakistan. The climate has changed since then, but the reluctance to come to Pakistan's rescue has not altogether died down.

Pakistan's decision to proceed with the Rs 1,700 crore Chashma Project should be seen only as the beginning of its nuclear effort. For, its 900 MW generation can satisfy only one-fifth of the present demand. For the satisfaction of a fivefold demand two decades hence, will warrant the installation of eight such reactors, and even then nuclear energy would be contributing only 35 of electricity if we succeed in installing them.

It is a big IF in the declining aid prospects from international agencies. We must, therefore, get as much assistance from as many sources as we can, including the U.S.A., West Germany and France and even the Soviet Union, which had made an offer of a reactor to us last year. After all, economic cooperation with Russia has not ceased despite political differences over Afghanistan, and in spite of them on other issues, we had entered into an agreement with Moscow for the exploration of gas and oil in the early years of the Ayub era. If Pakistan cannot have best of both the worlds, it should not resign itself to the worst of both.

CSO: 5100/4706

CANADA URGES PAKISTAN TO SIGN NON-PROLIFERATION TREATY

Karachi DAWN in English 1 Mar 83 p 1

[Text] LAHORE, Feb. 28: Signing of non-proliferation treaty (NPT) with acceptance of foolproof safeguards was the pre-requisite sought by the Canadian Ambassador to Pakistan for any future co-operation in the nuclear field between Pakistan and his country.

Talking to PPI here this evening, he said Pakistan's reluctance to sign NPT was the biggest disagreement between the two countries and added the co-operation could resume if Pakistan met the pre-requisite. "There is a lot of scope of co-operation (in the nuclear field) if we are on the same wave length," he added.

He said it was the policy of the Canadian government not to cooperate with any country in the nuclear field which was not a signatory to the NPT and that Pakistan was no exception. He said Canada had similar differences with India, Japan, Switzerland and many other countries of the world with the result that Canada did not cooperate with them.

Asked as to what extent Canadian-Pakistan nuclear co-operation could go if Pakistan signed the NPT, Ambassador Warden said the details could be worked out by the experts of the two countries.

He said Canada fully supported what he called the principled stand of Pakistan on Afghanistan problem and added that it lent full political support to Pakistan in the United Nations.

He said Canada had extended an assistance of 37 million dollars for refugees in Pakistan and that another two million dollars would be provided during the current year.

Ambassador Warden said Afghanistan issue was as alive in Canada as in Pakistan despite the elapse of three years to the Soviet invasion.

He evaded the question about the Palestine issue, but said his country had strongly criticised Israel over the massacre in two Palestinian camps in Lebanon.

Ambassador Warden claimed that Canadian people give great importance to the human rights in a country, but when asked if Isreali brutalities in Lebanon effected relations between Canada and Israel said "it is very difficult to answer" Nevertheless, he said, "we still maintain solid and positive relations with Israel as also with other Middle East countries like Lebanon, and Syria. Canada had a balanced approach, he added.

Answering yet another question, the Canadian Ambassador said his country maintained good relations with both Pakistan and India and supported efforts to improve relations between them.

He said he was trying to give a boost to trade between Pakistan and Canada and that Pakistan can increase its exports to that country if the businessmen made frequent visits there.

He said the outstanding Canada loans against Pakistan were very negligible. —PPI

CSO: 5100/4706

MUNIR AHMAD SAYS COUNTRY TRYING TO DEVELOP VIABLE NUCLEAR POWER INDUSTRY

Karachi BUSINESS RECORDER in English 21 Mar 83 p 1

[Article by Munir Ahmad]

[Text]

LAHORE, March 20: The Pakistan Atomic Energy Commission is endeavouring to develop a viable nuclear power industry in the country which can gradually increase its share in the construction of nuclear power plants to a level they can manufacture most of the key components locally.

This was stated here today by Munir Ahmed Khan, Chairman PAEC, while delivering his inaugural address on a 3-day seminar on "application of radio isotopes in industry". Organised jointly by the PAEC and the Nuclear Research Centre, KFK, Karlsruhe West Germany.

Besides, the PAEC and KFK, delegates from local industrial concerns are also participating in the seminar.

Munir Ahmed Khan offered the PAEC technical know-how to private industrialists in the fields of electronics, radioisotopes, chemicals and establishment of large gamma-sterilisation plants for the treatment of agricultural products and surgical goods.

He invited the local industry to make a contribution in the construction of 900 megawatt power plant at Chashma. But clarified that their contribution would only be acceptable provided stringent quality standards are maintained. There would be no compromise on the question of quality or safety-related aspects.

The PAEC is receiving international bids for the construction of this power plant, commonly know as Chashnupp.

Munir Ahmed Khan said the PAEC was prepared not only to apprise local industrialists of international requirements for the quality of nuclear plants components to enable them undertake timely upgradation and improve existing technology, but also help them in bringing them in contact with the suitable foreign manufacturers in order to get them necessary expertise and facilitate transfer of technology in this field.

RADIOISOTOPES TECHNIQUES

The PAEC Chairman emphasised the application of radioisotopes techniques for studying and resolving diverse and difficult problems of industry, agriculture and medicines.

Referring to the existing state of exports, Munir Ahmed Khan said "our economy is precariously balanced and controlled by factors beyond our control".

Munir Ahmed Khan said the existing industrial units in the country could yieldd ten times more production as compared with their present out put regretted the major constraints were the availability of technical manpower, managerial skills and enforcement of quality measures.

While stressing the use of radioisotopes, the PAEC Chairman said the government was considering a draft of safety regulations to ensure safety and that the new rules and regulations could be promulgated very shortly.

He expressed his hope that the participants of the seminar would prepare recommendations for promoting the use of radioisotopes in solving the problems of industry, agriculture and hydrology.

PINSTECH'S OFFER

Earlier, the Director, Pakistan Institute of Nuclear Science and Technology (Pinstech), Dr Naeem Ahmed offered the local industry Pinstech assistance in setting up radioisotope gadgets which he said could considerably cut down their expenses.

He proposed that technical personnel of various industries should be sent abroad for training in development of radioisotopes.

Dr. K.E. Rubi of Nuclear Research Centre, Karlsruhe, West Germany, said the administration of his country was very keen in developing cooperation with Pakistan in scientific field and hoped that a similar seminar would shortly be held in West Germany.—PPI.

CSO: 5100/4708

FRANCE MAY HELP SET UP NEW POWER PLANT

Karachi BUSINESS RECORDER in English 30 Mar 83 p 1

[Excerpt]

ISLAMABAD, March 29: France believes that every country has a right to acquire nuclear technology for peaceful purposes, whether it is Pakistan or Brazil, French Foreign Minister Claude Cheysson told a press conference here this evening.

In the light of this policy France was willing to be a partner of Pakistan, he said answering a volley of questions on France's position on Pakistan-France relations in the nuclear field.

Cheysson who was closely questioned by correspondents on the subject said discussions between Pakistan and France were going on with regard to the nuclear reprocessing plant subject from which France had withdrawn its commitment about five years ago. He said it would not be proper to let these discussions suffer by talking anymore publicly about this dispute from the nuclear chapter of the two countries.

He said his discussions with Pakistani leaders also included prospects of French cooperation in setting up a new nuclear power plant. At this stage he said he would not like to say more about this chapter.

Pressed by correspondents Cheysson said that the French company which was one of the foreign companies to bid for the new Pakistani nuclear power plant would be advised by the French government to insist on Pakistan for full-scale safeguards under the Vienna-based International Atomic Energy Agency.

He said if any country wanted to develop nuclear technology for peaceful purposes without signing the nuclear proliferation treaty, France would not oppose it. His country, he noted, had never supplied in the past nor would supply in future nuclear aid to any country which did not ensure full adoption of IAEA safeguards.

Asked why France had given nuclear fuel to India after US.A stopped it Cheysson said his country was not bound to follow the American policy in toto. "We have a right to differ with the Americans on this question", he said.

Cheysson went on to add that France did not believe in "full-scale approach" followed by America for extending nuclear aid to countries, viz, making condition that both the NPTsigning and the IAEA safeguards should be adhered to by a country needing nuclear assistance.

CSO: 5100/4708

SA ATOMIC ENERGY DEVELOPMENT DETAILED

Johannesburg RAND DAILY MAIL in English 18 Mar 83 p 9

[Article by Simon Barber: "Cajoling SA Back into the World's Nuclear Fold"]

[Text] By SIMON BARBER, who talked to United States government and atomic energy officials about their attitude towards South African atomic energy development.

THE neighbourhood hoodlum — who may be on the way to rehabilitation, but then again may not be — has a reputation for carrying a gun.

There's a suspicious bulge over his hip. You have two options. Step on his toes, which is dangerous, but what a lot of folks want you to do, or risk scandal by inviting him to join your club.

Such has been the United States' dilemma over nuclear power in South Africa ever since American and Soviet spy satellites made their controversial sightings over the Kalahari and the South Atlantic.

Washington knows not only that South Africa has at least the capacity to build an atomic "device" but also that it may shortly possess a viable independent nuclear industry, capable of enriching locally abundant uranium, fabricating it into reactor fuel and turning it into energy.

Which presents a pair of tough alternatives.

Either South Africa can be isolated as a pariah, in which case it might feel tempted to pursue a weapons programme and could sell its fuel and technology to other pariahs, thereby creating a serious proliferation problem.

Or South Africa can be cajoled back into the international nuclear fraternity, with its rules, safeguards and relatively open commercial and technological exchange.

President Jimmy Carter leaned toward the former approach.

Despite strident political opposition, the Reagan administration has adopted the latter.

There is strong evidence that vindication may be only months away.

Negotiations are about to begin that would enable South Africa to possess an internationally legitimate nuclear industry ranked in terms of capacity and technology with the industries of the United States and Europe.

The price tag for Pretoria is nothing more than common sense: the verifiable renunciation of atomic weapons.

Some background. Until 1975, the United States played a pivotal role in the development of South African nuclear power.

A co-operation agreement reached in 1957 is still on the books, though in an amended form, and is scheduled to stand until 2007.

After 1975, however, the relationship was considerably circumscribed. Amid fears that Pretoria was getting perilously close to the bomb, United States nuclear exports to South Africa were suspended.

Two conditions were set for lifting the suspension.

One — mandated by the 1978 Nuclear Non-Proliferation Act (NNPA) — requires South Africa to allow the United Nations's International Atomic Energy Agency (IAEA) to inspect all its nuclear facilities, a procedure known as "full scope safeguards".

The second, a matter of presidential policy rather than law, calls on South Africa to sign the Nuclear Non-Proliferation Treaty (NPT).

Persuading Pretoria to accept these conditions has been the most important item, aside from South West Africa, on the US administration's South Africa agenda.

Typical of "constructive engagement" as a whole, the strategy has been to accommodate South Africa's sensibilities rather than bludgeon them.

As it did on the SWA issue, the administration started out by trying to build Pretoria's confidence and achieve a clear understanding of what its real concerns were.

Thus, in August 1981, a team of South African technicians was invited to visit the new uranium enrichment plant at Portsmouth, Ohio.

Two months later, a United States team was asked back to see South Africa's enrichment project at Valindaba.

Meanwhile, to help clear the air of irritants, the United States eased export controls

to permit certain nuclear-related items to be shipped to South Africa.

An export licence applied for by the Control Data Corporation (CDC) to sell its powerful Cyber 170/750 computer to South Africa's Council for Scientific and Industrial Research (CSIR), denied under Carter, was granted, as were several similar applications.

Inevitably, there was an outcry, particularly when the US administration announced it would allow a company called Isotec to sell AEBs quantity of helium-3, an isotope used in tests of reactor fuel elements.

Critics — and they included such Republican moderates as Senators Charles Percy and Nancy Kassebaum — charged that helium-3 could be used to obtain tritium, a potential weapons component.

The US administration countered that, if South Africa really wanted tritium, it was far more readily produced from lithium, of which South Africa had ample reserves.

At the time of writing, Isotec has agreed to suspend its licence application.

Despite this setback, and in full expectation of increasingly feverish opposition, the administration is now moving to the critical phase of its effort to bring South Africa back into the nuclear fold.

"It may be a little early to say the process is bearing fruit," a well-placed United States official said last week. "But let us say it is about to blossom."

At the start of this year there were three main problem areas:

● The IAEA, which must administer the safeguards required by American law, has sought repeatedly to evict South Africa from its ranks. Unless the organisation accepts South Africa, there is little likelihood Pretoria will agree to safeguards.

● Contrary to popular misconception, South Africa has agreed to safeguards at almost all its nuclear facilities. The critical exception is Valindaba, where a pilot enrichment plant is operating and a commercial enrichment facility is under construction, due to come on stream in 1985.

Pretoria's reason for keeping Valindaba off-limits to IAEA inspection teams and equipment is that it does not wish to give away the secrets of its vaunted home-grown enrichment process.

It has also argued that, since a number of other IAEA members — the United States included — have not allowed inspection of their enrichment plants, there is no reason why South Africa should be a special case.

● In 1974 Escom contracted with the United States Atomic Energy Commission, since absorbed by the Department of Energy (DOE), to enrich South African uranium, starting in May 1980, for the Koeberg One power plant.

By some curious legal twist, which Escom contests, the South African company now finds itself contractually obliged to deliver uranium feed for enrichment, even though US law prohibits the enriched material being shipped back to South Africa.

Should Escom fail to maintain annual delivery — the next shipment is due in May — it will be hit, under the terms of the contract, with a R77-million penalty.

At first, US policymakers saw this as a way to lever South Africa into accepting full-scope safeguards and signing the NPT.

But it hasn't worked out that way.

Instead, Escom has found alternative sources and has also managed to defray some of the cost of delivery and enrichment by selling portions of its Oak Ridge account to American utilities much to the chagrin of DOE, whose prices it undercuts.

And now for the solutions.

According to US administration officials, the first problem has now been all but removed, there are no technical obstacles to the second, and, after that, the third should fall neatly into place.

At a meeting of the IAEA's board of directors in Vienna last month, the United States successfully prevented discussion of a resolution to expel South Africa from the agency's technical working groups.

The resolution had been mandated by the United Nations General Assembly in December and would, if accepted in Vienna, have gone before the IAEA general conference next September.

South Africa's membership of the agency has grown increasingly tenuous. It has not attended a general conference since 1979 when, in New Delhi, its credentials were rejected.

It has also been thrown off the agency's Committee for Assurances of Supply (CAS).

Having persuaded the board of governors to declare Israel a "fully participating member" at the Vienna meeting, the US administration believes the same can be done for South Africa.

Sources familiar with the Vienna session say that Eastern bloc members, who have often been closely in accord with the United States on proliferation, have expressed willingness at least to abstain on any further bid to oust South Africa.

The next step is to sort out the DOE contract, according to United States officials. Talks are due to begin within "six to eight weeks".

While the US administration is loath to detail its negotiating position, it is understood on good authority that the problem will be solved on "a long-term temporary basis".

This means that the United States will not, as has been suggested, simply terminate the contract.

But, at the same time, as one official explained: "We are not going to brandish the R77-million penalty either."

By thus showing goodwill with Escom, the US administration hopes to make the final breakthrough on safeguards for Valindaba.

The key to this is an agreement, due to go into effect on March 14, between Australia, West Germany, Japan, the Netherlands, Britain, the United States, the French-led nuclear group Eurodif and the IAEA, known as the Hexapartite Safeguard Project (HSP).

The pact is the result of a two-year search for a method of safeguarding that is applicable to all enrichment technologies and compromises none.

Armed with this — and United States officials insist the project was carried out with South African concerns specifically in mind — the US is confident Pretoria can be persuaded that Valindaba can be inspected without risk of industrial sabotage.

Moreover, it will be stressed that South Africa is no longer a special case since all cosigners of the agreement will now have safeguards at their enrichment plants.

Should South Africa still baulk at safeguarding the Valindaba pilot plant — and this, rather than the commercial installation, seems to be the major sticking point — the US administration is prepared to take steps that would eliminate the need for the plant's existence.

However, under a US-backed programme known as Reduced Enrichment for Research and Test Reactors (RERTR), South Africa has already agreed to modifications to Safari that would enable it to use 20% enriched uranium rather than the 45% grade currently needed, ... and produced at Valindaba.

If South Africa was to agree, as part of the full-scope safeguards deal, to close the pilot facility, officials here say, the United States might be prepared to provide 20% enriched fuel for Safari.

Whether the pilot plant is safeguarded or shut down, Pretoria will then have met the legal requirements for lifting the United States nuclear export ban ... thus effectively freeing Escom's Oak Ridge account for Koeberg.

Nonetheless, the second (policy) condition — that South Africa first sign the NPT — would remain unmet.

Officials point out that agreeing to full-scope safeguards is tantamount to denying that you have the bomb now.

Signing the NPT merely takes that one step further by promising never to build a "device".

The final question then is a political one.

On the one hand, can Pretoria take the plunge of forswearing nuclear weapons for ever, thus removing that element of unease among its enemies?

On the other hand, is the Reagan Administration willing, as elections draw on, to take on the storm of opposition that would undoubtedly rage over its failure to have South Africa sign the treaty before restoring nuclear co-operation to pre-1975 levels?

CSO: 5100/30

PALABRA MINING'S URANIUM SALES REPORTED

Johannesburg THE CITIZEN in English 28 Mar 83 p 33

[Article by Daan de Kock]

[Text] A URANIUM sale on the same magnitude as that achieved in 1982 has already been concluded for this year, chairman of Palabora Mining company, Alistar Macmillan, says in his annual report.

He said this, and the fact that copper sales could be maintained at relatively high levels this year, could result in reasonably satisfactory results for 1983. A lot, however, would depend on the copper price, Mr Macmillan said.

It is clear from his report that Palabora was very successful the past year in maintaining costs.

The latter was also one of the main reasons why the company was able to lift after-tax earnings from R19,8-million to R27,9-million in the year ended December 1982.

He pointed out that the company had saved an amount in excess of R2-million in the past year on the use of spares alone.

This was mainly the result of a training scheme introduced during the year to upgrade the skills of maintenance personnel.

Mr Macmillan also points out that the imposition of an import surcharge in February last year, which was subsequently reduced to 7,5 percent in December last year and the increase in GST in September last year had a significant impact on the company's import bill on capital equipment, spares and consumables.

Palabora's borrowing last year increased from R76,4-million to R92,8-million. The increase in the borrowings was mainly to finance additional stripping, which will lengthen the life of the mine by about seven years.

The company substituted some of its local borrowing facilities towards the end of the year for offshore loans on more favourable terms and loans totally £10-million were drawn in October and December last year.

At the time of going to the Press these loans were showing a substantial, unrealised exchange gain of some R1-million.

In addition, a five-year loan of US $3,6-million was arranged to finance the purchase of open-cast mining equipment on favourable terms.

Mr Macmillan says it is considered that the foreign exchange risks on both the sterling and dollar loans will be minimized as they can be repaid out of the company's export proceeds, which are receivable in both currencies.

CSO: 5100/31

BRIEFS

REPORT ON KOEBERG SLAMMED--The official opposition yesterday hit at the Government for using an alleged Government-sponsored mouthpiece abroad "Courrier Austral Parlemetair" for political propaganda. Mr John Malcomess, Progressive Federal Party spokesman on energy, said in a statement that a Government mouthpiece, "Courrier Austral Parlementair", had intimated that Koeberg alert might have been responsible for the explosion at Koeberg. He said this kind of political propaganda and double-talk was stupid and self-defeating. "I reject with contempt the implication that Koeberg alert could have anything to do with the explosion. "Furthermore, the ANC have claimed responsibility. "Our nucelar energy programme could do without this soft of biased political commentary. I, therefore, call on the Deputy Minister of Information to: "Firstly--dissociate himself from the standpoint of the CAP. "Secondly--to stop paying taxpayers' money into the coffers of this news bulletin which appears to have as its only source of funding the South African taxpayer. "Finally--we must ask the Deputy Minister a question--who wrote this article? "It would appear likely that it was written by a South African. Could it have been written by a civil servant, or even a Member of Parliament?" Mr Malcomess asked. [Text] [Johannesburg THE CITIZEN in English 29 Mar 83 p 4]

LOAN STOCK FOR ATOMIC ENERGY BOARD--Volkskas Merchant Bank and Union Acceptances have privately placed loan stock totalling R68-million on behalf of the Atomic Energy Board. The issue was by way of three loans, it added, comprising one 14 year stock at 84,62 rand percent at an annual interest rate of 10,50 percent with a yield to redemption on October 31, 1997 of 12,85 percent, a 19 year stock at 100 rand percent at 13 percent interest with a yield to redemption on the same date in 2002 of 13 percent, and a five-year stock at 100 rand percent at 12,50 percent interest with a yield to redemption of April 30, 1988 of 12,50 percent. [Text] [Johannesburg THE CITIZEN in English 3 Mar 83 p 23]

CSO: 5100/26

'VERY PROMISING' FIND OF URANIUM MADE IN SOUTH

Copenhagen INFORMATION in Danish 19-20 Mar 83 p 5

[Text] The first find of easily accessible uranium in high concentrations on Greenland does not have immediate prospects of being surveyed, said engineer Leif Lovborg of the "nuclear geophysics" group of Riso Test Facility.

The find of very promising uranium deposits in south Greenland is the culmination of a scientific project which began in 1979 and is ending at the end of this year, when there will be no more funds for the project. The last investigation in Greenland has been done, and only the writing of reports remains.

"From a purely geological point of view it is very bad to stop now, when a promising find has just been made, and nobody yet knows how much there is, since only 5 to 10 percent of the area has been surveyed," said Leif Lovborg.

By comparison the long-recognized uranium deposits at Kvanefjeld are 30-times less concentrated and much more difficult to extract.

It is, however, up to Greenland's Geological Research to decide how the survey is to continue, while the Riso Test Facility is a sort of subcontractor.

The attitude of the Greenland Home Government toward continued surveying is, however, decisive since the home government controls the exploitation of Greenland's raw materials via the Raw Materials Administration.

The current research project was originally started with EC support in 1979, but at the time of the EC referendum on Greenland they decided not to seek EC support, and since then the Ministry of Energy research fund has covered the expenses.

In connection with the project the Riso Test Facility developed a special measuring apparatus for measurements taken from the air. That was because

of the very difficult terrain, and because for economic reasons only a very small helicopter could be used. The apparatus, which uses microprocessor technique, is therefore smaller and lighter than any other well-known equipment for that purpose.

On a chance helicopter flight, the equipment located the find, where tests showed it was the same type of uranium ore which is mined in Canada, the United States and Australia.

9287
CSO: 5100/2581

EX-MINISTER OPPOSES FAST BREEDER, HIGH TEMPERATURE REACTORS

Hamburg DER SPIEGEL in German 7 March 83 p 84-92

[Article by Andreas von Buelow: "No Chance for Fast Breeder"]

[Text] With the fast breeder, the FRG wanted to get aboard modern nuclear technology. However, in the opinion of former Research Minister Andreas von Buelow, who was responsible for the breeder and wrestled with industry over its financing until October 1982, the concept is uneconomical and outmoded.

The fast breeder in Kalkar (SNR 300) and the high-temperature reactor at Hamm (THTR300) have generally been touted as symbols of economic-technical accomplishment in the FRG. This made it hard for the research minister to give the projects the sober scrutiny they deserved.

Between 1980 and mid-1982 there occurred two rounds of cost escalations for both reactors: the SNR 300 increased by 75 percent to DM6.5 billion; the THTR 300 by 66 percent to DM4 billion. Financing was no longer assured for both reactors; the shortfall amounts to at least DM3 billion.

In the summer of 1982, I, as research minister of the liberal-socialist coalition, initiated a fundamental reevaluation of both projects and their prospects.

In retrospect, it would have been prudent to have undertaken this reevaluation immediately after the first cost escalation at the end of 1980 and before negotiations with industry over participation in project financing--which negotiations in any event secured over DM1 billion.

Just after the change of governments, I publicly stated that both projects have wound up in the backwash of energy politics. After a long and difficult learning process filled with many obstacles, I now deem it necessary to mothball both projects in spite of their advanced stated of construction. Their potential utility no longer bears a reasonable ratio to the additional cost of the overall systems.

Above all I fear that a CDU-led government will lack the courage to own up to the fact that billions in public funds have been sunk into hopeless and

uneconomical technologies. But even they will one day have to recognize that the prerequisites for the economical utilization of new energy technologies have fundamentally changed.

Since the beginning of the 1970s, the growth in energy demand has continually been overestimated. From the vantage point of 1973, primary energy consumption for 1985 was supposed to be at 610 million hard-coal-unit (SKE) tons [wherein 1 SKE is the heat equivalent of 1 kg of hard coal]. In the meantime, the estimate for 1985 has been revised downward to 430 million tons SKE. Actual energy consumption has decreased from 1973 to 1982 from 378 to 363 million tons SKE.

Since the beginning of the 1970s, the power-plant builders have calculated an annual growth in electrical demand of 7 percent and more. But since 1979 consumption has stagnated. Independent of swings in the business cycle, a progressive decoupling of economic growth and energy consumption is taking place because of conservation and new technology. Even today's estimates are already obsolete.

This resulted in oversupply and price reduction of uranium. The uranium shortage which in theory justifies the use of the fast breeder is not foreseeable. The nuclear power plant costs, on the other hand, have risen enormously in almost all countries regardless of authorization procedures or people's protests.

For German power plants there has been an average annual price increase of 17 percent since 1969. For generating electricity, the cost advantage of nuclear energy compared to its chief competitor hard coal has been decreasing worldwide. During 1982 in the United States alone, 28 reactor projects with a power of 31,000 megawatts, were postponed and 18 with a power of 22,000 megawatts were stopped.

The originally calculated cost advantage of nuclear energy is shrinking not just because of the increasing investment cost but also because the useful life of nuclear power plants and the cost of waste disposal were estimated too optimistically.

Instead of the assumed utilization rate of 6,500 hours per year, the power plants achieved an average of just 4,700 hours per year during the period 1978 through 1981. Reprocessing and final storage were figured at DM2,200 with an annual inflation rate of 6 percent. In the meantime, however, Cogema, the French concern active in the field of commercial reprocessing, is quoting DM3,500 per kilogram just for the reprocessing work. Final storage is added on to this, and cost over-runs of several hundred percent are not out of the question in some cases.

If nuclear energy is unsuccessful in expanding beyond electricity and making a greater penetration into the heating market--and this possibility is already viewed as marginally attractive--then its expansion is bumping up against clearly defined demand limits.

Large segments of industry like chemicals, steel and aluminum which together consume 60 percent of industrial energy are making a permanent saving in electricity through new technologies. The same holds for private households. Growth-intensive branches of industry which will come on as future large energy consumers are not seen on the horizon at this time.

The increasing use of microelectronics is also a fuel saver. Because oil accounts for only 5 percent of the electricity generated, the propaganda "nuclear energy has to replace oil" is not convincing. An annual growth in electrical demand from 2.5 to 3.5 percent through 1995 is unlikely even if business is good.

If the SNR 300 had been planned and developed by business itself without massive public investment, then it probably would have stopped a long time ago because of the changed energy situation and the cost explosion.

Up to October 1982, a total of DM2.5 billion had been expended for the SNR 300. Outstanding obligations, primarily public funds, amount to an additional DM1.6 billion. Just the average requirement for further development of the overall system could run higher than DM10 billion. Included in this are the costs for system delivery, deficit operation of the SNR 300, development of the fuel cycle and the required participation in an SNR-300 successor program.

The technical concept of the Kalkar breeder will not be used for follow-up projects. The method used by the French has won out, and the SNR 300 will be a one-of-a-kind design. Follow-up systems--if they are built at all--will be of french design and initially built in France.

Hence in the FRD there is no chance for a follow-up project on the basis of the SNR 300 which the industry would finance alone, yet, this was the original purpose of the Kalkar breeder national promotion.

The investment and operating costs of a breeder built under French construction and authorization regulations are of course much higher than those of a conventional light-water reactor (LWR). The price of uranium would have to increase by 1,000 percent before the extra costs could be recovered through fuel savings alone.

At present prices in the FRG, a breeder will always be between DM2 and 3 billion more expensive than an LWR. The costs of the yet-to-be-completed development of the associated breeder fuel cycle are not included in the above figure. These costs will require spending an amount as great as that spent on development and construction of the SNR 300. And without an economical fuel cycle there can be no economical utilization of the fast breeder.

The much-discussed "better utilization of uranium in a breeder" which is supposed to lead to a 6,000 percent saving is a quantity from theoretical physics whose practical realization is out of the question for the foreseeable future.

The claimed savings in foreign exchange through decreased uranium use hardly pays. Even an increase in the price of uranium from about DM120 kg today to DM1,000 kg would save only about DM1.5 to 2.0 billion in an optimistic breeder scenario for the year 2015, for example. Compared to this is the gigantic capital expenditure of over DM100 billion for a 10,000 to 13,000 megawatt breeder system. In thinking this way, we are dealing with expensive dreams of self-sufficiency in an economic fog. Because of its capital intensity, the fast breeder can never compete commercially with the LWR, to say nothing about other methods for generating electricity.

It thus appears better to me to write off the approximately DM4 billion already spent instead of sinking another more than DM10 billion for follow-on costs into this technology.

Other countries are also abandoning the illusions of breeder technology. In the United States, the comparable Clinch River project has not been furthered since the mid-1970s. Its costs are also escalating. The U.S. General Accounting Office has estimated the cost at over DM20 billion. Ford Foundation experts would postpone the whole breeder scenario in the USA by at least 15 years.

In Great Britain the government, after long discussion, agreed at the end of 1982 to postpone from 1986 to after 2005 a decision concerning an additional breeder project; low economic feasibility was the reason. Even in France disenchantment is setting in for the El Dorado of nuclear energy.

The electricity monopoly Electricite de France (EdF) lost DM2.9 billion last year and has lost a total of DM5.6 billion since 1975; further, it is in debt for about DM50 billion. On the other hand, electrical demand shows a decreasing trend; expensive refurbishments and decreased availability of nuclear power plants burden the nuclear energy balance significantly. The breeder reactor Super Phenix is finished but it has its own uses for France as a nuclear-weapon nation. A follow-on project would have to work economically.

Because of the preceding considerations, breeder technology does not have a chance for commercial utilization during the next 50 years. The bill can only be paid by massive government subsidies in the billions; however, no country can afford continuous subsidies of this magnitude. Other tasks are more important. Thus it does not make sense to couple the future of the industrialized FRG to such an expensive technology.

The future of the high-temperature reactor does not appear to be any better. ure electricity generation this technology cannot economically compete conventional light-water reactors, according to power industry statements. For heat-power coupling--the use of rejected heat from generating electricity for space heating--areas of utilization totaling less than 300 megawatts are seen at this time. Thus a THTR 300 will never be used just to generate electricity.

The nuclear gasification of coal--another often propagandized field of application--is burdened by a number of unsolved problems. The industry thus

sees no possibility of proposing a follow-on project based on concrete business considerations and financed by industry. Rather it requests, without stating its own level of participation, billions in government subsidies. Without subsidies the THTR 300 will likewise not have a successor and will remain a one-of-a-kind system which would be better mothballed.

Nuclear energy may thus still be economical and safe if based on light-water reactors but should be limited to the generation of the amount of electricity regularly required, that is, to provide base load requirements. Its constrained expansion depends on additional demand for electricity and on the economical alternatives of better energy utilization. In addition, the waste disposal problem must be solved. The costs for this have been underestimated to date. It further appears worldwide that doubt now surrounds the requirement for reprocessing spent fuel elements. Absent here also is a reevaluation with realistic cost estimates.

The possible expansion of light-water reactors for covering base load deficiencies in the supply of electricity is then just one of the several building blocks of a reasonable energy policy. With respect to the objectives of further energy savings, increased conservation of resources and the environment, better energy utilization and utilization of all conceivable energy technologies, there is fortunately widespread unity. In connection with this, the legal and financial instruments will have to be thought through again otherwise the unity is only an illusion.

FDP Minister of Economics Otto Graf Lambsdorff has, for instance, to date refused to restructure the supply monopoly for electricity and gas, which is anchored in the Energy Law of 1935, to meet the needs of modern times. Because of this refusal fair competition among all parties, especially the new energy technologies, is hindered.

Thus, in the case of electricity, industrial and communal energy generation--especially the injection of electricity from the heat/power coupling and wind and solar generators--has to be allowed, not at ruinous prices but at prices comparable to those required by the regular power plants. With more competition, electrical energy may become cheaper, and a new rate structure may be required. The present structure favors large customers too much and encourages waste, not conservation.

Fundamental changes are necessary in heat generation and consumption, including incentives for energy-conservation investments, changes in construction codes, better use of waste heat and expansion of heat distribution facilities. This is the only path to lowering the percentage of imported oil. Distributed heat in particular has to be favored in a new energy law so that it receives equal market chances with electricity and gas.

The proliferation of heat-power plants which are optimal from the standpoint of energy utilization is presently impeded because the electric power companies--due to their monopolistic position--will not pick up the associated electricity at all or will no so only at dumping prices. Waste heat goes

largely unused even though it could be a valuable commodity in the heating market.

As with large coal and nuclear power plants, heat power also has to be provided lead financing for 10 to 15 years via rates.

Resources and environment conservation have been especially neglected to date in the energy laws. Environmentally friendly technologies such as flue-gas desulfurization and fluid-bed firing, which have been brought to market maturity with government support, have to be installed in old and new coal-fired power plants, especially because of the consequences of acid rain. We urgently need an immediately effective renovation program for old facilities. The Coal Administration has had only a superficial effect. The many loopholes in the regulations just shove the problem back on the shelf.

The limited funding available from the government has to go to shortage and growth areas. There is no other way to maintain the environment and to advance the modernization of our economy. Technological and industrial policy is better focused on developing microelectronics, communication technologies, new raw and finished materials and eco- and biotechnologies than on subsidizing nuclear energy.

These technologies create growth and employment in a much shorter time. If just half of the billions required for development of the breeder system were invested in these growth fields, incomparably more would be done for innovation and the competitive position of the German economy.

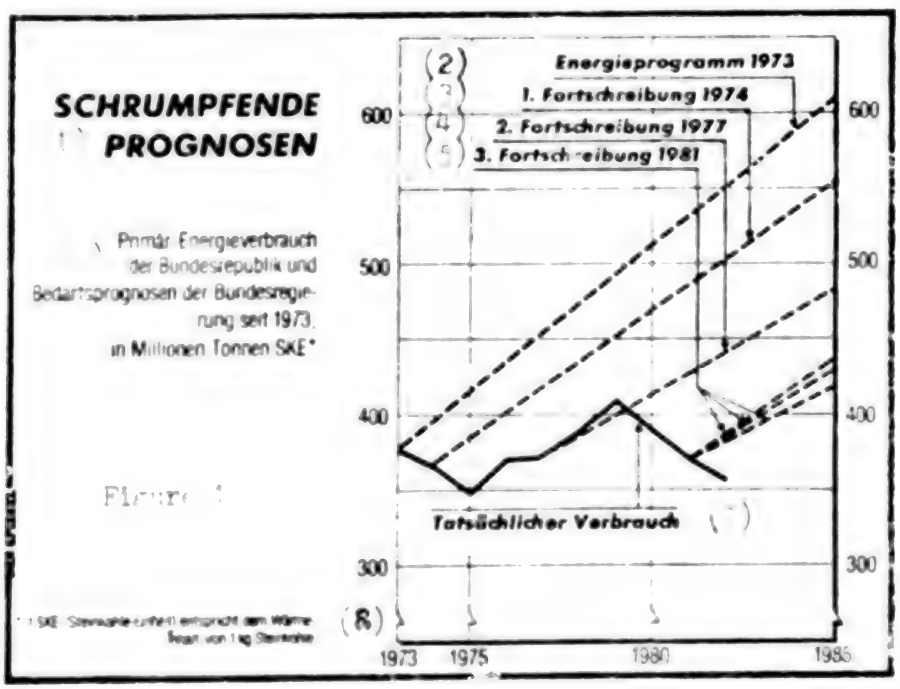


Figure 1

Key on following page

Key to Figure 1:

1. Shrinking projections
2. Energy program of 1973
3. First extension, 1974
4. Second extension, 1977
5. Third extension, 1981
6. Primary energy consumption of the FRG and government demand projections since 1973 in millions of tons SKE
7. Actual consumption

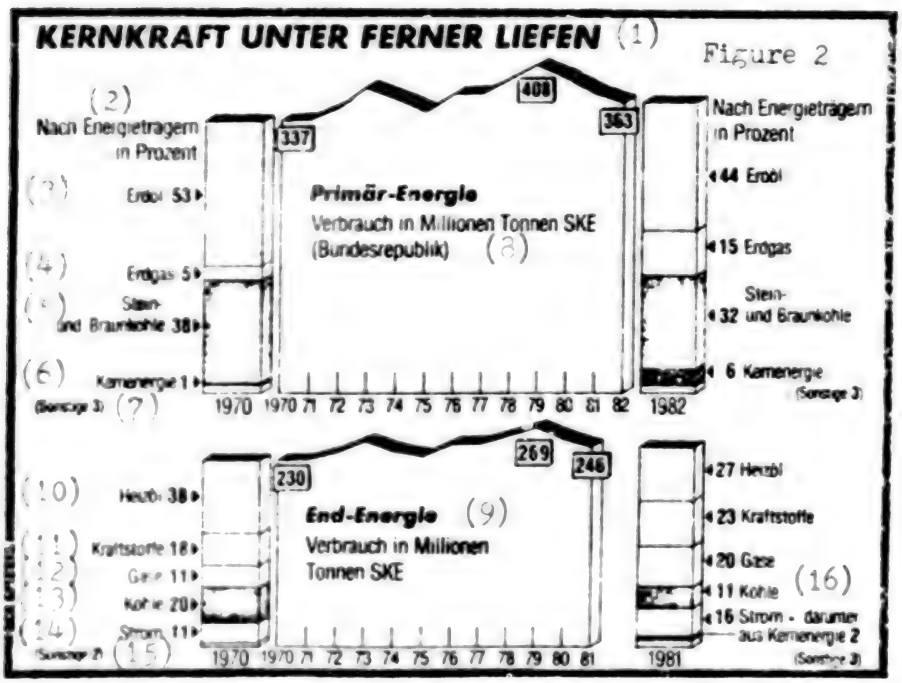


Figure 2

Key to Figure 2:

1. Nuclear power under foreign supply
2. According to energy material in percent
3. Petroleum
4. Natural gas
5. Hard coal and lignite
6. Nuclear energy
7. Other materials
8. Primary energy consumption in millions of tons SKE, FRG
9. End energy consumption in millions of tons SKE

Continued on following page:

10. Heating oil
11. Gasoline
12. Gas
13. Coal
14. Electricity
15. Other forms
16. Electricity from nuclear power

9160
CSO: 5100/2574

EXPERTS CLAIM BURYING OF NUCLEAR WASTE NOT ADEQUATE SOLUTION

Helsinki SUOMEN KUVALEHTI in Finnish 4 Mar 83 pp 28-29

[Article by Pekka Suominen, Raimo Lilja, and Juha Saarinen: "Nuclear Waste in Bedrock Undermines Safety"]

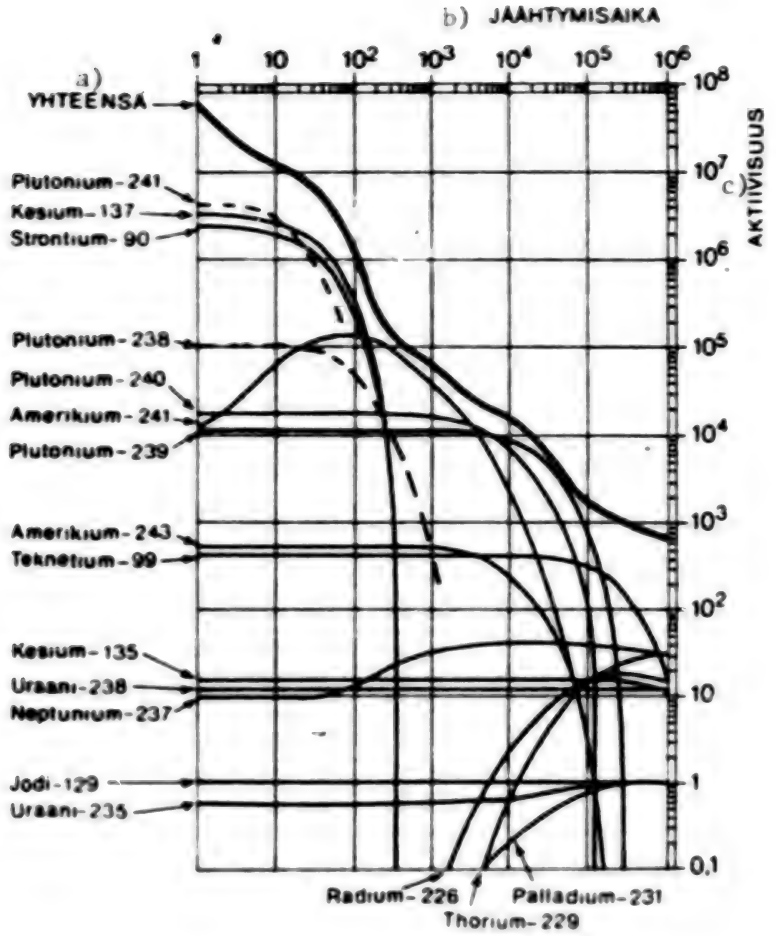
[Text] The authors of this article are Physics Lecturer Pekka Suominen of Jyvaskyla University, Graduate Engineer Raimo Lilja, who is working as a researcher at the Karelian Research Station of Joensuu College, and student of physics Juha Saarinen of Helsinki University.

Last November Teollisuuden Voimo Oy [Industrial Power Company] published a report on its plans to arrange for the final disposition of the spent fuel from its Olkiluoto Plant. The solutions presented in the report clearly differ from those concepts which were prevalent when Finland began to enter the atomic age. The plants at Olkiluoto are presently functioning with only a temporary permit, which will expire at the end of this year. The need for the power company to prove that its waste problem has been resolved is urgent.

In the initial years the most active spokesman for the nuclear power companies in matters of nuclear waste was the Finnish Association of Power Plants, which stated in its nuclear power report in 1974 that the plutonium in spent fuel is a valuable substance and that it will be isolated in a treatment plant for future use as a reactor fuel. It is further stated: "Since it is not worth-while building treatment plants in Finland, the treatment of waste to be transferred to foreign plants will have to be handled by international agreements."

Industrial Power's New Solution

A definite contradiction compared to the previous intentions becomes evident from a new report by TVO [Industrial Power] entitled "Final Disposition of Spent Nuclear Fuel in Finland's Bedrock". Spent fuel will not be transferred to foreign treatment plants. "Valuable" plutonium will continue to remain a problem. The graphic representation of the radioactivity of spent fuel in the beginning of the report is worthy of attention. Instead of a 1000 years, its life span is now a million years.



The radioactivity of spent fuel and its decrease according to a report published by Industrial Power last November. On the time table, for example, 10^3 = 1000 years and 10^6 = a million years. The unit of activity is a gigibecquerel or a billion becquerels per one uranium ton. As late as 1975 the Association of Power Plants presented a corresponding graph, in which total activity decreased to zero in a 1000 years already. Now in the TVO report activity is "eternal" or high even after a million years. The two plutonium isotopes (238 and 241) "forgotten" by TVO were adde' to the graph with a dotted line by Pekka Suominen.

Key:

a) Total
b) Cooling time
c) Activity

The increasingly important plutonium isotopes Pu-238 and Pu-241, which have been added to the curve by a dotted line, are missing from the original graph presented by TVO. From the graph it becomes apparent that the transuranic

elements in spent fuel are from the very beginning just as significant radiators as the fission products kesium-137 and strontium-90, to which the power companies have so far attempted to limit the nuclear waste discussion as far as hazards are concerned.

Amerikium is also now clearly included in the radioactivity curve. Am-241 is a most forceful radiative transuranic substance after it is formed from the plutonium-241 isotope over a period of a few decades. Amerikium is not among the elements in the plutonium of a nuclear bomb, but it is a new problem substance generated by nuclear power plants. The amount of amerikium in waste increases with the certainty of the laws of nature even after present-day nuclear power plants have ceased to operate.

Amerikium is an exceptional element even among the elements related to similar actinic substances. Chemically, it may behave in the manner of calcium, and calcium, on the other hand, is one of the basic substances of all life. It has been confirmed in agricultural experiments that amerikium is transferred from soil to plants significantly easier than plutonium. The concentration phenomenon of such nuclear wastes comprises a significant factor of uncertainty in evaluating the safety of storing nuclear wastes.

In granting operational permits to nuclear power plants Finland's political decisionmakers have had to make their decisions on the basis of assumptions which the power companies have now demostrated to be incorrect. Several tons of waste, the hazardous nature of which is not temporary, have already been produced in Olkiluoto under the protection of temporary operational permits.

Unfortunately, TVO's latest solution is, to a great degree, based on assumptions. The basic concept of this solution is the depositing of waste fuel in metal capsules to be buried at a depth of 500 meters in bedrock. Primarily on the basis of foreign computer programs TVO has concluded that in the worst instance a resident in the vicinity of a waste site may receive a radiation dosage, which will only be one-hundredth of the present amount of background radiation in the environment, after 2.5 million years. Thus according to the TVO report, the waste problem has been resolved and numerous areas in Finland have been confirmed to be suitable waste disposal sites although no single location has been proposed or studied from this point of view.

In the United States the government has decided to spend approximately 3000 million markkaa annually on the study of nuclear waste over a period of 15 years. If the level of security is already of the quality and class proposed by TVO with present technonology and the most pessimistic assumptions, why should the technonology of waste solutions be further improved from year to year and why should studies be continued in various parts or the world?

The basis of TVO's report is made up from the Swedish example, Karnbranslesakerhet-project or KBS. However, the TVO report is not able to refute the forceful international criticism directed at the KBS report. This criticism is briefly presented in the following.

Criticism of KBS Report

Upon completion of the KBS project an evaluation of it was requested from more than 20 Swedish and foreign experts in the years 1977--1978. The majority of these making statements considered that the proposed plans do not fully guarantee safe storage.

The key question from the point of view of the disposition of wastes in bedrock is how and when ruptures, which are encountered to a depth of 10,000 meters, came about? KBS's answers point to rather distant periods of time before the last ice ages when earthquakes and volcanic eruptions occurred in Scandinavia. It is believed that more recent movements of bedrock took place (and will take place in the future) in these old and known areas of movement and ruptures.

When KBS and TVO talk about a "stabilized" bedrock, they mean that between the old fault lines there is sufficient whole bedrock, which in addition it is assumed will remain solid far into the future. The new studies do not support this kind of view.

The KBS-project also assumed that the "average movement" of bedrock mass is 0.3--0.02 mm per million years. In the same manner TVO states that swelling of the earth "as a relatively even and slow phenomenon will not endanger the safety of the final disposition of wastes". However, the fact is that in Finland the annual swelling of the earth is approximately 1--10 mm and this swelling is not even, but intermittent, uneven, and difficult to precisely predict. TVO also emphasizes that Finland's bedrock is among the world's most stable, but, nevertheless, even in Finland there have been approximately 300 earthquakes, the force of which has fluctuated beween 1--5 on the Richter scale, in the years 1610--1980. It cannot at all be considered certain that these phenomena, among other things, cannot cause new ruptures.

Also the following questions were avoided in the reports by KBS and TVO:

The origin of horizontal ruptures (so-called rebound features), which are very prevalent at a depth of 400--500 meters, is unexplained even though the question is of the utmost importance from the point of view of the safety of bedrock storage.

The so-called low earthquakes occurring at a depth of approximately 300 meters are not dealt with in the KBS report. Such an earthquake, for example, was confirmed in Sweden in the 1979.

Safety guarantees extending until after the next ice age (see TVO's 2.5 million years) are obviously unrealistic: movements of bedrock several meters long were prevalent at the end of the last ice age and under such conditions ground water can transport wastes to the surface of the earth rather quickly. The next ice age will occur after 20,000 years according to certain estimates.

Perhaps the worst mistake in the safety analyses of TVO's report is in the fact that they are based on a premise according to which nuclear wastes can

enter the environment only by means of extremely slow-moving phenomena of erosion and earth movements. In other words, the fact that nuclear waste capsules could suddenly break open because of bedrock ruptures has been almost completely ignored.

However, in the susceptibility analysis this possibility was conceded in a manner in the IVO report by including the effect of a rupture in one capsule (just as in the KBS report). It was confirmed that the radiation dosage from one capsule would theoretically increase 250-fold. It was arbitrarily assumed that such an accident could occur around the year 3050 when the effect of isotopes with a shorter life would be negligible. However, it is completely possible that there could be tens or hundreds of ruptured capsules. In such an instance a catastrophe would be evident whether a rupture took place in 50 or 50,000 years. There would be no opportunities to prevent such a catastrophe since the storage facilities would be sealed shut as in the KBS model.

Also practical attempts have for the time being failed or are incomplete. In Sweden drilling in Sterno, Finnsjo, and Krakemal has shown that the bedrock has too many ruptures. In Switzerland the study of locations for the storage of nuclear wastes is only beginning. England's first strorage location studies were completed in 1980, but the results were surprisingly declared to be confidential. In 1982 the continuation of nuclear waste boring was abandoned completely in that country since according to official reports it is perhaps after all wisest to build underground storage for waste, which can be supervised and from which waste can be removed if necessary.

Thus, compared to experiences in foreign countries IVO's indifferent statement that "geological formations suitable for the final disposition of spent fuel are to be found in numerous areas in Finland" should, indeed, be considered optimistic.

In the opinion of several experts geological knowledge as applied to predicting the future is still completely insufficient for explaining the safety level of KBS-type bedrock sites for the storage of nuclear wastes. This has been confirmed by, among others, the respected commission of geological experts, the Neotectonics Commission of INQUA as well as researchers Witherspoon, Bibb, and Gale of the international Stripa-nuclear waste project.

[illegible] factors of uncertainty in the solution presented by IVO [illegible] in this connection except by mentioning them:

The risks of temporary storage (approximately 40 years) preceding final disposition.

The effects of thermal, radiation, and chemical conditions on the durability of the metal capsules and the movement of radioactive substances.

The long-term effect of heat (the thermal radiation of wastes) on the properties of the bedrock and the course of ground waters.

The possible eruption of helium gas released in alpha radiation to the surface of the earth, at which time a transmission channel would open up for radioactive substances also.

The effect of quarrying and boring at a disposal site on the durability of the bedrock over the long term.

The properties of the filler materials in the bedrock sites and particularly the density of the seams in the bedrock and the filler.

Nuclear Wastes Being Politicized

TVO's plans clearly differ in certain questions from the views of the representatives of several political parties, which were made public at a nuclear waste seminar sponsored jointly by the Finnish Environmental Protection League and the Energy Policy Association on 27 February 1982. The most important of these points were:

Should the prerequisite for the granting of an operational permit to a nuclear power plant be the same as in Sweden's so-called conditional law, which requires that an applicant for a permit must indicate a known and named site in which wastes will be deposited? Representatives of the SDP, Center Party, and the Finnish Christian League gave an unambiguous positive answer.

Would you approve the revocation of the monopoly of municipal planning if no municipality voluntarily accepts wastes? The Conservative Party, Center Party, Finnish Christian League, and the Swedish People's Party gave an unconditionally negative answer while the leftwing parties considered this to be possible.

Should nuclear wastes be disposed of in such a manner that their removal from the disposal site would be possible if it is determined that they will be a threat to ground water? The SKDL [Finnish People's Democratic League], the Conservative Party, Center Party, Swedish People's Party, and the Finnish Christian League gave a positive answer, the SDP stated that "it is not necessary to nail down a technical solution for a long time".

TVO's most recent report is closely tied in with three timely energy policy events: The expiration of the temporary operational permit for TVO's power plants, the presentation of new nuclear legislation to parliament, and above all the possible decision to procure a new nuclear power plant. The nuclear waste problem is rapidly moving from the technical arena to the political.

10576
CSO: 5100/2377

NEW NUCLEAR PLANT MAY BE BUILT IN 1983

Helsinki HELSINGIN SANOMAT in Finnish 10 Mar 83 p 12

[Article: "Nuclear Power Plant To Be Built Perhaps This Year Already"]

[Text] Lovisa--Finland's next nuclear power project will be subjected to public discussion immediately after the parliamentary elections. A proposal for a general electricity management plan will be presented to the Ministry of Trade and Industry on 30 March. It includes, among other things, the construction of a 1000-megawatt nuclear power plant to begin this year already or next year.

The general electricity management plan is considered to be a plan of the power companies, whose representatives were the primary parties participating in the preparatory work.

According to information presented in the most recent energy report of the Ministry of Trade and Industry, a vote was taken on the general plan and the inclusion of a nuclear power plant won by a vote of 9--2.

There was no desire to publish the general plan before the elections according to the opponents of nuclear power since it is feared that the nuclear power position contained in it would become a political issue.

Making the issues public has, however, acquired peculiar traits from the nuclear power position contained in the plan already disclosed in the energy report of the KTM [Ministry of Trade and Industry]. The confusion of the issue is reflected in the fact that Erkki Vaara, section chief of the energy section, considers the general electricity management plan already to be public, but the chairman of the electricity management council, Vaara's subordinate, Esko Ylikoski, contends otherwise. According to Ylikoski, the general plan will be made public according to normal procedure only after it is presented to the ministry. Ylikoski also considers that the information contained in the energy report was made public prematurely.

Ylikoski and Vaara will also be making public statements in the future when the general electricity management plan will be discussed.

The energy policy council, whose general secretary is Erkki Vaara, will also be issuing a statement on the general electricity management plan.

The Ministry of Trade and Industry will be presenting its proposal on the general electricity management plan to the cabinet, which will also have to take a stand on the nuclear power project.

Power Companies in Cooperation

Since the general electricity management plan is considered to be the creation of the power companies, its competitor in parliament will be the energy policy program which was completed in the December 1982. The cabinet gave its blessing to it in February.

The energy policy program did not take a definite stand on the nuclear power plant projects so that positions on nuclear power issues will be made in a democratic discussion on the basis of the paper presented by the power companies.

Finland's next nuclear power project will be promoted jointly by Imatra Power and Teollisuuden Voima [Industrial Power]. According to the schedule of the research project, the reports required by the construction permits for the 1000-megawatt nuclear plant will be completed in December 1983.

Inasmuch as the power plant is built in 1983--84 as is stated in the general electricity management plan, there should be no significant interruptions in the project. According to General Manager Magnus von Bonsdorff of Industrial Power, the completion of the project in accordance with the general elecricity management plan would also be possible on the basis of the present planning schedule.

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POLITICAL LEADERS DIVIDED ON NEED FOR NEW NUCLEAR PLANT

Helsinki HELSINGIN SANOMAT in Finnish 10 Mar 83 p 12

[Article by Antti Vahtera: "Parties Boast of Criticism"]

[Text] A proposal supporting the construction of a 1000-megawatt nuclear power plant has been made at the official level in the electricity management council. A decision was made already in the middle of January, but it will not be submitted to the Ministry of Trade and Industry until after the elections.

The delay is apparently the result of the fact that this issue is felt to be too sensitive before the elections. The positions of the parties regarding a new nuclear power plant have recently become definitely more critical, and several civic organizations have presented statements of protest.

At the same time pressure on the side of the producers of electricity is increasing on behalf of the construction of a new nuclear power plant. For Imatra Power it is becoming a question of employment while, on the other hand, Finnatom, which markets structural parts for nuclear power plants, is earnestly hoping for an increase in business.

However, the growth of electricity consumption has come to a halt in Finland, which has resulted in the fact that the 1000-megawatt coal-operated power plant completed in Inga at the end of the 1970's is standing almost idle.

The sensitiveness of the issue is emphasized by the fact that the parliamentary energy policy council (EPN) established in 1977 has, for the most part, been left outside of the decisionmaking process concerning the new large power plant.

Officially, it is actually a question of an alternative decision between three types of power plants, namely nuclear, coal, and peat. However, in Imatra Power, which was given the task of studying the alternatives, as far as is known, 90 percent of the research time was devoted to nuclear power.

Some experts consider that the decision regarding the construction of a new nuclear power plant has already been made in practice. This is reinforced by the proposal contained in the general electricity management plan, about which there have previously been indefinite references in public.

The above-mentioned proposal, which is discussed in the new energy report of the Ministry of Trade and Industry, was presented on Tuesday evening at a discussion held at Helsinki University. The representatives of the four largest parties and the green movement as well as Doctor of Engineering Markku Nurmi, an expert in energy policy, participated in it.

Power Companies Were Absent

The discussion was arranged by the environmental section of the Helsinki University Student Union and the nuclear work group of the Environmental Protection Institute. Approximately 150 people were present.

Representatives of Imatra Power and Teollisuuden Voima [Industrial Power] were also invited to the occasion, but they declined. Representatives of the Ministry of Trade and Industry, who were invited in place of the absent representatives of IVO [Imatra Power] and TVO [Industrial Power], also did not attend.

IVO excused its absence by the fact that "IVO has no reason to discuss issues which are still being considered in state organs. The company's appearance at public discussions could be interpreted as an attempt to pressure officials."

Graduate Engineer Hannu Penttila, chairman of the discussion, pointed out that their absence emphasizes how sensitive and urgent the parties concerned consider the question of a new large power plant to be.

Tuimioja: Positions Have Softened

The politicians who participated in the discussion emphasized that the positions of their parties have become ever more critical and rejecting almost across the board. Only Ari Aberg of the Conservative Party avoided a definite stand one way or the other.

Thus Erkki Tuomioja of the Social Democratic Party confirmed that traditionally energy policy has been considered as a support for a growth policy, which does not have an independent position in society. The most recent party program of the Social Democrats, in which it is stated that society must strive for a development model of the least energy consumption, reveals a definite change in positions. Nuclear power contains so many risk factors that energy management should not be left in its dependence to any significant degree.

Pietila: Projects Are Now Absurd

Center Party's Hilkka Pietila considered the present situation to be completely absurd. We are planning a new large power plant at a time when there is an overcapacity of energy production in Finland corresponding to four nuclear power plants.

Pietila considers that the Center Party has adopted a more critical attitude than the other parties toward nuclear power for many years. She considered

that the growth of the need for energy is not a law of nature, but that this need can be regulated.

Aberg: Growth Is Not A Bugbear

Aberg of the Conservative Party emphasized the close connection between economic growth and energy policy. In his opinion growth should not be considered a bugbear, we can at least control it. He also saw no reason for the immediate construction of a new nuclear power plant.

Ludenius: Time Against Nuclear Power

Martti Ludenius of the People's Democrats pointed out that the SKDL [Finnish People's Democratic League] approved in its 1979 party platform a critical statement on nuclear power, which has since been made even stronger. In his opinion time is working against nuclear power.

However, Ludenius emphasized that other sources of energy also contain large risks. He pointed out the detrimental environmental effects caused by hydropower and the acid rains caused by fossil fuels.

Soininvaara: Only The Greens Have Their Own Line

Osmo Soininvaara of the greens emphasized the benefits of a "soft" social model: it saves energy and raw materials, and it is better to live in such a manner. In his opinion the political parties are more reminiscent of chambers of commerce, idealism is absent.

In Soininvaara's opinion all the large parties have adopted approximately the same line in the nuclear power question. Only the green movement emphasizes responsibility for the future as well as global responsibility. The question of nuclear power is essentially a moral question, particularly when the long-term effects of waste are taken into consideration.

Nurmi: Finland A Leader in Nuclear Power

Markku Nurmi pointed out that Finland has become a world leader in the production of electricity produced by nuclear power. Its proportion is 40.3 percent, and in France, which is in second place, its proportion is 38.7 percent. Indeed, by applying different methods of calculation slight fluctuations in the statistics can be achieved.

Nurmi pointed out that in addition to the general electricity management plan, the nuclear energy law has also been postponed until after the elections.

In Nurmi's opinion pressures for the construction of a new nuclear power plant are not in fact the result of a commercial policy as of the "hard line" energy policy being carried out. The frantic investments, which continued into the middle of the 1970's, resulted in the doubling of personnel at IVO from 2000 to 4000, for example. Now as investments have plummeted, IVO's engineers and technocrats are being threatened by mass unemployment unless a new large power plant is built.

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PAPER COMMENTS ON POLITICAL DEBATE REGARDING NUCLEAR PLANT

Helsinki HELSINGIN SANOMAT in Finnish 11 Mar 83 p 2

[Editorial: "New Parliament Faced With Power Plant Problem"]

[Text] The energy management council established by the cabinet has included the construction of a 1000-megawatt nuclear power plant in the new general electricity management plan. The general plan, which is second on the agenda, is being used by the cabinet as a basis for granting permits for the construction of the power plant.

In the previous plan scheduled for the years 1982--1991 there was only talk of a new large power plant. Now it has become a nuclear power plant.

Since the composition of the council is weighted in the direction of the power companies and their interest groups, the inclination toward the use of nuclear energy is no suprise. Nuclear power continues to be the most economical of the forms of energy and its risks are considered to be exaggerated at least in power plant circles.

In spite of this, the parties have labelled nuclear power as a sensitive question. For this reason, no clear stand is being taken on it even in the new energy policy program approved by the government.

The reluctance of the parties to enter into an energy discussion before the elections has been a matter of expediency. To a great degree, this has been the result of doubts connected with nuclear technology, which to the layman are impossible to prove correct or incorrect. In questions of nuclear power one has had to trust in the statements of experts whether they are in the final count correct or incorrect.

In practice the proposal of the electricity management council, however, means that the parliament now being elected will be faced with the nuclear power question. The solution will be in the hands of the MP's and subsequently in the hands of politicians who will become members of the cabinet. Now it is rather difficult for them to take a stand on understandably difficult to comprehend and in part emotionally directed energy questions.

From the point of view of future solutions it is essential that hasty positions not be taken now that the nuclear power plan has come up. The lines drawn over energy policy before us now are so far-reaching that irretrievably tying one's hands in the last moments of the election campaign can endanger the balanced management of the whole energy economy. It is not sufficient that one form of energy is opposed at a time -- be it nuclear energy, coal, hydropower, or peat -- but a functional alternative must be offered in place of the rejected form of energy. A mere energy policy populism, on the other hand, would take away the credibilty of a candidate to parliament.

Future MP's will have to study the alternatives of energy technology, make a decision on their basis, and bear the responsibility for it. It follows that parliament must also not enter into a discussion in principle justifying a quick decision on a new nuclear power plant immediately after the elections.

The new representatives must be given reasonable time to become familiar with the issues. Even the power companies must understand such a demand.

PRIVATE VS GOVERNMENT SPONSORSHIP DELAYS URANIUM EXPLORATION

Athens AKROPOLIS TIS KYRIAKIS in Greek, 27 Feb 83 p 11

/Article by Manos Khorianopoulos: "Civil War Over Uranium"/

/Text/ Florina will become an Eldorado of uranium--the AKROPOLIS TIS KYRIAKIS reveals today--following the surprise discovery of very rich uranium deposits located east of Florina at the place called Akhlada near the foothills of Kaimaktsalan. The discovery was made by a special scientific team using the most up-to-date methods. It is strange, however, that the government for its part remains silent. Worse still in spite of this precious discovery, the exploration has stopped while the government itself condones and maintains this situation, preparing for partisan reasons--as charged by opposition deputies--to dissolve the Directorate for Radioactive Mineral Exploration /DERO/ of the "Dimokritos" /Nuclear Research Center/ and to assign all exploratory work to the Institute of Geological and Mineral Research [IGME] which has only rudimentary experience and infrastructure for such exploration--as charged openly and responsibly by the Dimokritos Scientists Association, as we will explain later.

Yet, a scientist who is familiar with the situation but prefers to remain anonymous for his own reasons, which of course we respect, told AKROPOLIS TIS KYRIAKIS yesterday that "this is the most important discovery ever made in the Greek subsoil. It is destined to change radically the country's economy since--following the initial estimates--we can get cheap energy for many decades."

The Study

In the face of this great revelation--which goes back to October 1977--it is strange that there has been no public announcement--not from this government or by the previous New Democracy government. This is even more incomprehensible: For over a year every exploratory work has been suspended in the Akhlada-Florina area while absolutely verified reports of the AKROPOLIS

state that Professor And. Frangiskos of the National Metsovion Polytechnic School has drafted a special study on the extraction of uranium from the Florina deposits (U_3O_8), but this study was never taken up even though it was submitted at least 10 months ago to the Research and Technology Service /YET/

The specialist geologists who have studied this precious discovery claim that the uranium-rich ores in Florina can be regarded among the richest in the world, in addition to the fact that they cover a very large area and that they are easily accessible because the ores are near the surface.

Freezing

A comparison of the quality of the Florina to the Serrai ores, for example, which are also exploitable, gives the following data:

One ton of Florina ore can yield up to 3 kilograms of uranium (U_3O_8) while the Serrai ore yields only 300 grams of U_3O_8. Nevertheless, in spite of the initial optimism prevailing among the scientists of the Greek Atomic Energy Commission /EEAE/ and IGME, indescribable pessimism and bitterness prevail now, especially within the commission. This pessimism and bitterness increasingly deepens for the following reasons:

The "freezing" of the explorations--especially in the Florina area. Worse still the open war which has been going on for 6 months now against the pioneering research group in our country, i.e., DERO (of the Dimokritos Nuclear Center). IGME is trying--and appears to be succeeding--in dissolving Dimokritos to bring under its jurisdiction all programs of nuclear research and the responsibility for the exploitation of the country's mineral resources.

This is an unreasonble demand by IGME--according to a confidential report by the Dimokritos Scientist Association--because "the active and systematic effort to locate the deposits was started by EEAE in 1971 and now occupies 20 scientists and 38 technicians, compared to IGME which started to work in uranium exploration in a rudimentary way in 1975 and has now only 4 scientists (2 of them former employees of the Atomic Energy Commission) and a small number of technicians. In this area IGME coverage is minimal or non-existent."

The DERO geologists add that the overall handling of this issue by the provocative IGME "hegemony" is aimed shamelessly at the essential abolition of Dimokritos and the humiliating downgrading of the role of reliable scientists: geologists, geophysicists, nuclear scientists. In addition, it has caused indescribable confusion among those responsible in this vital

energy sector. Moreover, it holds in limbo a very significant issue--such as the exploitation of uranium--which is so necessary today with the fuel crisis--for the country's development efforts.

The effort to place the research programs under IGME jurisdiction--according to members of the Scientists Association of the Nuclear Center--is spearheaded by PASOK party groups which want to bring under partisan control the service for geological explorations.

Partisan

The same circles emphasize that for this reason a 9-member work team has been formed by "select" representatives of the related agencies: EEAE, IGME and the Public Power Corporation /DEI/, and following a study of the subject it suggested the following to the Ministry of Research and Technology:

"It is more useful for the country to have a single agency for geological exploration. It was decided that IGME should be this agency."

In the same "work team" document (12 August 1982) those who make the suggestion deal with the fate of the regular personnel of the dissolved agencies and see the following three possibilities:

a. To be transferred to IGME upon request;

b. To be temporarily transferred to IGME while remaining organizationally with EEAE; and

c. To join the various EEAE research programs.

The Research

The Scientists Association of Dimokritos--which has already explored 75 percent of the country with "radiomeasuring self-registering Geiger counters"--respond to the statements of the work team as follows:

"The Scientists Association of Dimokritos considers sound the existence of a coordinated agency for geological deposit exploration for radioactive ores, but disagrees with the suggestion that IGME must be that agency. Based on the same criteria taken into account by the work team, it finds that EEAE is the more appropriate agency for all phases of the uranium cycle from exploration to utilization. This is why:

"a. There is a legal framework which provides for the participation of EEAE in the entire uranium cycle.

"b. The active and systematic effort to locate the deposits was started by the Atomic Energy Commission in 1971 and now occupies 20 scientists and 38 technicians."

Stagnation

The existence of two agencies dealing with the uranium cycle is excessively on the side of the EEAE since IGME, with its small team, can only partly cover the sector of drilling. We note that the drilling is only a small part in the overall uranium cycle which starts with the Geiger search and, at least currently, ends with the laboratory analysis and mapping. The part of IGME throughout this cycle is minimal or nonexistent.

Today we see inexcusable inactivity in the exploration and discovery of nuclear deposits while the special scientific manpower at the disposal of the "co-responsible" state agencies remains almost entirely unused--in spite of the energy crisis which has been going on for years throughout the world.

We are told, however, that a few days ago an amendment was introduced--as a rider to an unrelated bill--to take care of the problem. It would be a blessing if during the debate a spirit of cooperation prevails in the framework of a new research agency for the selection and use of more worthy scientific personnel which we have in this country. And this without partisanship.

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STUDY FORECASTS EXPECTED LIFE FOR NUCLEAR PLANTS

Stockholm SVENSKA DAGBLADET in Swedish 16 Feb 83 p 9

[Article by Bo Ostlund: "Safety Study: Reactor Will Last at Least 40 Years"]

[Text] The life expectancy of the Swedish nuclear power program is at least 40 years and at most 110 years, the latter applying to our most modern boiling water reactors. However, embrittlement problems as a result of neutron radiation have already been found on the oldest reactors, for example Oskarshamn I.

This is evident from a safety study not yet made public, which a group of specialists with experts from the Waterfall Agency, Oskarshamns Power Group (OKG), Sydkraft, Studsvik and Asea-Atom keeps "rolling," as commissioned by Kraftsam, that is to say the old CDL (Central Power Supply Board), which ceased to exist in mid-year 1982.

The report was discussed at the annual meeting of the Nuclear Engineering Association in the Engineering Building in Stockholm on Tuesday before invited nuclear technologists.

Unique Study

The study is unique--both Swedish and foreign experience is gathered and processed continuously. A series of control stations, among others the surveillance capsules in the reactor vessels (built in from the outset) of Swedish and foreign nuclear power plants, are measured and the reports dated as they go along.

The report already shows that the Swedish reactor program, in accordance with the popular referendum decision to abolish it, will be shut down right in its middle age, just about when the reactors have been paid for.

"If any one today were to demand an answer to how long a life expectancy our reactors will have, we cannot reply other than to say that it is a matter of at least 40 years--it being understood, however, that Oskarshamn I will require certain measures," says chief engineer Sven-Erik Widahl from the Waterfall Agency, a member of the specialist group.

"But as we take the surveillance capsules out of the containment vessels of the reactors we will be able to answer that question with more certainty."

The system of built-in surveillance capsules is also used abroad. This is why the group has also been able to study the experience abroad, for example from France, Finland and the United States.

Repairs

In Finland it has already become necessary to undertake certain modifications of the Soviet-supplied reactor in Lovisa.

Consequently, it is possible to do something about--meaning to halt and delay--embrittlement effects in reactor vessels, the report shows.

In France and Finland the outermost layer of fuel rods has been removed and replaced with other rods, which in turn are capable of sustaining the high radiation damage between the core and the inner wall of the reactor vessel.

The reactor vessel is exposed to four kinds of stress: neutron radiation, which makes it brittle, age, corrosion and fatigue, as a result of pressure and temperature, among other things.

"We seem to be able to exclude age and corrosion," Widahl says. "Fatigue affects mainly other portions of the systems, such as the steam generators. It is embrittlement which is the problem. And it turns out that OsKarshamn I has already taken some of that punishment."

"But for this still applies that no limit values which require a shutdown and an end to continued utilization will occur for another 40 years," Widahl says.

For Barseback, test results of the surveillance capsules so far indicate that the limit is 110 years.

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PAPER COMMENTS ON PROPOSAL TO HALT REPROCESSING OF WASTE

Stockholm SVENSKA DAGBLADET in Swedish 21 Feb 83 p 2

[Editorial: "Final Waste"]

[Text] Energy Minister Birgitta Dahl has taken the intitiative for joint discussions between the parliamentary parties regarding future storage of spent nuclear fuel.

At present it is presumed that at least a portion of the nuclear waste will be reprocessed. As is known, we have an agreement with the French establishment Cogema for this.

It is obvious, however, that the other final storage alternative, direct final storage without reprocessing, is gaining ground as being more advantageous from several viewpoints. Simultaneously, an in part very inflamed debate is going on, that Sweden should immediately cease all shipping of spent fuel for reprocessing.

When it comes to the main part of Sweden's future nuclear energy waste, for which no decision has yet been made as to the method of storage, the best thing would be to take it easy. There is no hurry at all. It is best to have "interim storage" of the waste until it is time for a definite decision. Technical research and development work will then be able to provide a better foundation for decisions than what we have today.

It would be surprising if the result were not direct storage of that waste which today is not already under contract for reprocessing.

Another question is what to do with the spent fuel, for which Sweden has already made binding reprocessing agreements. Breaking such an agreement means that one is still liable to pay. In practice, this means that a few billions will be poured down the drain.

This does not seem very sensible. That much money we do not have.

The consequences of fulfilling the reprocessing agreement have been substantially exaggerated. There are warnings against the risk that France

would appropriate the plutonium produced during reprocessing of the Swedish waste and use it for nuclear weaponry.

Now, Sweden has reliable guarantees that this will not happen. It has been safeguarded through meticulous control by the international atomic energy agency IAEA that the plutonium will remain Swedish.

Furthermore, France cannot have any interest in this material. That would presume that France did not have access to any other more cheaply produced and more effective nuclear weapons material. But France does.

Five-party negotiations can be useful on these issues, although the government naturally cannot evade its particular responsibility. But we should expect governments of various colors during the long period in which nuclear fuel storage will be important for Sweden. In that case, a certain amount of continuity is valuable.

It is perhaps likely that a majority could be built around a sensible solution between the three parties which are quite close to one another from an energy-political point of view: the Social Democrats, the Conservatives and the Liberal Party.

On the other hand, it still seems incomprehensible that Deputy Prime Minister Ingvar Carlsson a week ago was able to point out nuclear fuel storage as an issue said to be particularly suited for cooperation between the Social Democrats and the center (including the Center Party), a cooperation which would have the purpose, indicated by Carlsson himself, of preventing the Conservatives from "getting too big in the mouth."

Characteristically enough, Energy Minister Birgitta Dahl was not at all capable of explaining what Ingvar Carlsson meant. Neither is he, probably.

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